



## Arlington Conservation Commission

**Date:** Thursday, November 19, 2020

**Time:** 7:30 PM

**Location:** Conducted by Remote Participation

Please note: The listing of matters are those reasonably anticipated which may be discussed at the meeting. Not all items listed may in fact be discussed and other items not listed may be brought up for discussion to the extent permitted by law.

### Agenda

#### 1. Administrative

- a. In accordance with the Governor's Order Suspending Certain Provisions of the Open Meeting Law, G. L. c. 30A, § 20 relating to the COVID-19 emergency, the November 19, 2020 public meeting of the Arlington Conservation Commission shall be physically closed to the public to avoid group congregation. The meeting shall instead be held virtually using Zoom.

Topic: Conservation Commission Meeting

Time: November 19, 2020 07:30 PM Eastern Time (US and Canada)

***Register in advance for this meeting:***

[https://town-arlington-ma-us.zoom.us/meeting/register/tJwsdOqrzloE9FXXtKNmR9KXsa-6fuCwEs\\_](https://town-arlington-ma-us.zoom.us/meeting/register/tJwsdOqrzloE9FXXtKNmR9KXsa-6fuCwEs_)

Members of the public are strongly encouraged to send written comment regarding any of the hearings listed below to Conservation Agent Emily Sullivan at [esullivan@town.arlington.ma.us](mailto:esullivan@town.arlington.ma.us).

Please read Governor Baker's Executive Order Suspending Certain Provision of Open Meeting Law for more information regarding virtual public hearings and meetings: <https://www.mass.gov/doc/open-meeting-law-order-march-12-2020/download>

- b. Review draft 11/05/2020 minutes.
- c. Review draft letter to ZBA re: Thorndike Place updated comprehensive permit application.
- d. Review draft 2021 meeting schedule

#### 2. Discussion

- a. Regulations Update:  
Section 31: Climate Change Resilience  
Section 23: Floodplain  
Section 24: Vegetation Removal and Replacement



## Town of Arlington, Massachusetts

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### Review draft 11/05/2020 minutes

#### **Summary:**

Review draft 11/05/2020 minutes.

#### **ATTACHMENTS:**

Type	File Name	Description
<input type="checkbox"/> Reference Material	11052020_Minutes_Conservation_Commission.pdf	11052020 draft minutes



## Arlington Conservation Commission

Date: November 5, 2020

Time: 7:30pm

Location: Conducted through Remote Participation using Zoom

### Minutes

Attendance: Commission Members Susan Chapnick (Chair), Pam Heidell, Dave Kaplan, Nathaniel Stevens, Chuck Tirone (Vice Chair), and David White; Associate Commissioners Cathy Garnett and Doug Kilgour; and Conservation Agent Emily Sullivan. Commissioner Mike Gildesgame was not in attendance. Members of the public included Jeff Alberti (Weston & Sampson), Alexandra Gaspar (Weston & Sampson), Elena Compter (Weston & Sampson), Michael Richard (Weston & Sampson), Michael Rademacher (Director of Arlington Public Works), Sarah Tuttle (Arlington Resident), and Xavid Pretzer (Arlington Resident).

### 10/01/2020 Meeting Minutes

The Commission discussed edits to the draft 10/01/2020 minutes. N. Stevens motioned to approve the minutes as edited, D. White seconded, all were in favor, motion approved.

### 10/15/2020 Meeting Minutes

The Commission discussed edits to the draft 10/15/2020 minutes. D. White motioned to approve the minutes as edited, D. Kaplan seconded, all were in favor, motion approved.

### Conference Updates

S. Chapnick summarized recent conference presentations made by members of the Commission. These conferences include the Massachusetts Association of Conservation Commissions' (MACC) Annual Fall Conference and Association for Environmental Health and Sciences Foundation (AEHS) Annual International Conference on Soils, Sediments, Water, and Energy. S. Chapnick, N. Stevens, and E. Sullivan presented at MACC and S. Chapnick and E. Sullivan presented at AEHS.

### Notice of Intent: 51 Grove Street, Arlington Department of Public Works

MassDEP File #091-0326

#### Documents Reviewed:

- 1) DPW Facility 51Grove Street NOI, prepared by Weston & Sampson, dated October 22, 2020
- 2) Arlington Town Yard Facility 51 Grove Street NOI Plan Set, prepared by Weston & Sampson, dated October 21, 2020

#### Resource Areas:

- 1) *100-ft Wetlands Buffer*
- 2) *Adjacent Upland Resource Area*
- 3) *200-ft Riverfront Area*
- 4) *Floodplain and Floodway*
- 5) *Mill Brook*

This project proposes a new/renovated Municipal Facility to support the Department of Public Works (DPW), Inspectional Services Department (ISD), Facilities, and IT departments at 51 Grove Street. The proposed site includes the current 4.4-acre parcel, used by DPW / ISD, and an adjacent 1.4-acre portion of Town-owned land for a total of 5.8 acres. The site has Activity and Use Limitations (AUL) as defined by MassDEP due to site contamination, and therefore has contact barriers and engineered barriers (mostly pavement) per MassDEP requirements to prevent exposure to underlying contaminated soil. Sections of the site are within the 100-ft Wetlands Buffer, AURA, and 200-ft Riverfront Area of Mill Brook, as well as floodway and floodplain.

The Conservation Commission had a working session for this project proposal during its August 20, 2020 meeting.

Jeff Alberti from Weston & Sampson presented the project. Stormwater improvements include an underground detention area, deep sump hooded catch basins, and hydrodynamic separators. Three rain gardens are also proposed for the site. J. Alberti stated that the proposed planting plan for this project is consistent with the approved planting plan for the abutting Arlington High School project.

This project proposes high reflectance roofs on the buildings to mitigate for heat island effect. The proposed plantings and trees are also proposed to mitigate for heat island effect.

D. Kaplan stated that the stormwater aspects for the project were improvements. D. Kaplan recommended that the proposed stormwater treatment unit #4, proposed between Buildings C and D could be replacement with a catch basin to maximize treatment. D. Kaplan also recommended adding a stormwater treatment unit between the berm and Building D.

D. Kaplan recommended that the materials storage area should be canopied or graded such that runoff from the area, potentially contaminated with materials, does not enter the stormwater system. J. Alberti stated that sometimes canopies impede the operations of a site if too low, and if too high are ineffective. J. Alberti stated that Weston & Sampson will look into both recommendations for the materials storage area.

D. Kaplan noted that the planting plan proposes ash trees. D. Kaplan expressed concern for ash trees given the issues in Massachusetts with the Emerald Ash Borer, and recommended that the planting plan propose another tree species or include a management plan. J. Alberti stated that he would consult with the landscape architect for this project on tree species selection.

P. Heidell noted that the Cornell Method was used for the stormwater calculations. P. Heidell stated that the State is in the process of updating its Stormwater Handbook, and is considering changing the standards so that the NOAA Atlas 14 Plus numbers must be used for stormwater calculations. P. Heidell recommended that the stormwater calculations be recalculated with the NOAA Atlas 14 Plus numbers.

P. Heidell asked if the rain garden areas could be larger. J. Alberti stated that they could not be larger due to the AUL limitations of the site. P. Heidell asked if green roofs had been considered for the site. J. Alberti stated that the project is considering solar panels and not green roofs.

P. Heidell asked if this project had coordinated with the Arlington High School project for drainage considerations. E. Compter stated that yes, this project had several meetings to coordinate with the High School project on drainage and plantings.

P. Heidell asked if an equipment pad was considered for equipment in the 100-year and 500-year floodplains. J. Alberti stated that the proposed equipment area was at least 10-ft above the 100-year floodplain and therefore above the 500-year floodplain.

P. Heidell stated that some of the stormwater specification language was incorrect and recommended revising it. P. Heidell also requested that impervious/pervious calculations be broken out to the 200-ft Riverfront Area and 100-ft Wetlands Area so that the Commission could better understand resource area impacts.

S. Chapnick requested that the stormwater calculations be recalculated with the NOAA Atlas 14 Plus Plus numbers rather than the NOAA Atlas 14 Plus numbers.

S. Chapnick stated that she was pleased with the stormwater improvements proposed in this project, and stated that this project was a model project for stormwater improvements.

S. Chapnick noted that the project proposes to reduce Total Suspended Solids (TSS) from stormwater runoff by 80% in the new impervious areas. S. Chapnick stated that the proposed Stormwater Mitigation Bylaw revision that the Town has drafted requires 90% TSS removal for new impervious surface. S. Chapnick requested that the project reduce TSS by 90%, not 80%, for new impervious surface.

S. Chapnick asked if the project was considering educational signage elaborating on the stormwater improvements for the site. S. Chapnick also asked if more trees were being considered in the proposed parking area, which is currently a practice field. S. Chapnick stated that more trees would mitigate heat island effect and acknowledged that this area is outside of Conservation Commission jurisdiction.

C. Tirone noted that the Riverfront improvements consisted primarily of native plantings. C. Tirone recommended that the project maintain plantings for longer than three years, and should consider survivability statements and replacement guarantees.

C. Tirone asked if the new salt shed is going to be lined. J. Alberti stated that there will be two layers of lining, creating a “boat foundation”.

S. Chapnick requested that the planting plan include an invasive management plan, similar to what was submitted and approved for the Arlington High School project.

C. Tirone noted that the TSS removal for existing impervious surface is 44%. C. Tirone requested that the project remove more than 44% TSS for existing impervious surface.

C. Tirone asked for more information on the new generator. E. Compter stated that generator would be diesel. The generator would be double wall leak protected and the area would be graded and directed to a catch basin with a hydrodynamic separator. Bollards would protect the generator during fill, and it would be on a concrete pad with containment berms.

J. Alberti stated that the Commission’s stormwater recommendations were good recommendations, and that Weston & Sampson needed to investigate how the recommendations would interact with the AUL and whether they were feasible given the site constraints.

C. Garnett noted that Weston & Sampson designed the Reservoir Dam project, and those plantings have done very well. C. Garnett recommended that Weston& Sampson follow the same requirements and practices for the DPW project that they used for the Reservoir Dam project. D. White agreed that the trees and vegetation have done well at the Reservoir.

S. Chapnick opened the hearing for public comment. D. Pretzer, an abutter to the project site, stated that he appreciated the stormwater improvements. D. Pretzer stated that he was still concerned with site’s culverts because they are choke points for Mill Brook and create upstream flood issues. D. Pretzer asked that stormwater improvements be considered that also alleviate the culverts as choke points.

S. Tuttle, also an abutter to the project site, tried to provide public comment but there were some audio technical issues. E. Sullivan asked S. Tuttle to email her comments.

The Commission reviewed the requests it had made to the Applicant during the hearing:

- 1) Stormwater: on sheet c-6 0-3, replace stormwater unit 4 with catch basin
- 2) Stormwater: consider proprietary separator/treatment unit between Building D and berm where existing stormwater system is
- 3) Stormwater: consider adding canopy to materials storage area
- 4) Stormwater: consider grading materials storage area so sheet flow does not enter stormwater system
- 5) Vegetation: reconsider proposed ash trees, or develop management plan
- 6) Stormwater: update stormwater calculations with NOAA Atlas 14 Plus
- 7) Stormwater: update stormwater calculations with NOAA Atlas 14 Plus Plus

- 8) Stormwater: update specification language
- 9) Impervious Area: breakout impervious surfaces calculations into 200-ft Riverfront Area and 100-ft Wetlands Buffer
- 10) Stormwater: consider making the 80% TSS reduction in new impervious area a 90% TSS reduction
- 11) Amenities: consider opportunities for educational signage regarding stormwater improvements
- 12) Vegetation: strengthen statements of vegetation survivability, replacement, and maintenance; consider longer maintenance period than three years
- 13) Vegetation: include invasive management plan
- 14) Stormwater: consider increasing the proposed 44% TSS reduction in existing impervious area

N. Stevens motioned to continue the public hearing for the DPW NOI to the Commission's 12/03/2020 meeting, D. White seconded, all were in favor, motion approved.

### **Regulatory Update: Stormwater Management Section**

The Commission reviewed and discussed Section 33: Stormwater Management for the Arlington Regulations for Wetlands Protection.

### **Regulatory Update: Floodplain Section**

The Commission reviewed and discussed Section 23: Land Subject to Flooding (Boarding and Isolated) for the Arlington Regulations for Wetlands Protection.

### **ZBA Update on Thorndike Place**

S. Chapnick stated that the Applicant had submitted a revised comprehensive permit application to the ZBA, including:

- Report on Existing Conditions (Section 3.2.6 of Arlington Comprehensive Permit Regulations)
- Architectural Drawings
  - 3D Perspective View (1 sheet)
  - Floor Plans (4 sheets) - Garage, Ground Floor, Typical 2nd/3rd, and 4th Floor
  - Exterior Elevations (3 sheets) showing all building sides with Material Legend and Type of Construction
  - Courtyard Section (1 sheet)
- Site Plans revised November 3, 2020 reflecting new building program presented at the October 13, 2020 public hearing
- Stormwater Report
- Wildlife Habitat and Vegetation Evaluation
- Updated waiver request list
- Statement of Compliance with Arlington's Master Plan, Housing Production Plan, and Open Space and Recreation Plan.

S. Chapnick, N. Stevens, and P. Heidell volunteered to draft a comment letter to the ZBA regarding these new materials. The draft comment letter will be reviewed by the Commission at its 11/19/2020 meeting in advance of the ZBA's 11/24/2020 meeting.

N. Stevens motioned to close the Commission meeting, D. Kaplan seconded, all were in favor, motioned approved.

Meeting adjourned at 10:25pm.

DR



## Town of Arlington, Massachusetts

### Draft Letter to ZBA

#### Summary:

Review draft letter to ZBA re: Thorndike Place updated comprehensive permit application.

#### ATTACHMENTS:

Type	File Name	Description
□ Reference Material	ZBA_Transmittal__Supplemental_ApplicationMaterials_2020-11-03.pdf	Thorndike Place Revised Comprehensive Permit Application Transmittal Sheet 11032020
□ Reference Material	Thorndike_Place_Waiver_Request_11032020.pdf	Thorndike Place Waiver Request 11032020
□ Reference Material	Report_on_Existing_Site_Conditions_Nov.2020.pdf	Thorndike Place Existing Conditions Report 11032020
□ Reference Material	Thorndike_Place_Plan_Set_Revised_11032020.pdf	Thorndike Place Revised Plan Set 11032020
□ Reference Material	Thorndike_Place__Stormwater_Report_11032020.pdf	Thorndike Place Stormwater Report 11032020
□ Reference Material	Thorndike_Place_Wildlife_Habitat_and_Vegetation_Evaluation_11032020.pdf	Thorndike Place Habitat and Wildlife Evaluation 11032020
□ Reference Material	ZBA_Transmittal_-_Wetland_Delineation_2020-10-22.pdf	Thorndike Place Revised Wetlands Delineation Transmittal Sheet 10222020
□ Reference Material	Thorndike_Place_Wetland_Delineation_Memo_REVISED_10-19-2020_gtd.pdf	Thorndike Place Revised Wetlands Delineation Memo 10192020
□ Reference Material	2340700-CONSTRAINTS_w_Updated_Wetlands.pdf	Thorndike Place Revised Wetlands Delineation 10222020
□ Reference Material	Wetland_Delineation_Field_Data_Forms.pdf	Thorndike Place Revised Wetlands Delineation Field Data Sheets

□ Reference Material Thorndike\_Place\_Compliance\_with\_MP\_HPP\_OSRP\_11032020.pdf

10152020

Thorndike Place  
Demonstration of  
Compliance with  
Local Plans  
11032020

□ Reference Material Thorndike\_Place\_Architecture\_Binder\_110.pdf

Thorndike Place  
Architecture  
Binder 11032020

**Sent Via Email**

November 3, 2020

Christian Klein, Chair  
Arlington Zoning Board of Appeals  
51 Grove Street  
Arlington, MA 02476

RE: Thorndike Place  
Supplemental Application Materials

Chairman Klein:

As identified in the Supplemental Response to Completeness Review Memo dated September 25, 2020, on behalf of the Applicant, BSC is submitting the following revised and supplemental Thorndike Place Comprehensive Permit application materials for review in advance of the next scheduled public hearing on November 24, 2020:

- Report on Existing Conditions (Section 3.2.6 of Arlington Comprehensive Permit Regulations)
- Architectural Drawings
  - 3D Perspective View (1 sheet)
  - Floor Plans (4 sheets) - Garage, Ground Floor, Typical 2nd/3rd, and 4th Floor
  - Exterior Elevations (3 sheets) showing all building sides with Material Legend and Type of Construction
  - Courtyard Section (1 sheet)
- Site Plans revised November 3, 2020 reflecting new building program presented at the October 13, 2020 public hearing
- Stormwater Report
- Wildlife Habitat and Vegetation Evaluation
- Updated waiver request list
- Statement of Compliance with Arlington's Master Plan, Housing Production Plan, and Open Space and Recreation Plan

Under separate cover, the Applicant is submitting the requested replenishment of the Peer Review Fees to Mary Musyznski, Department of Planning and Community Development as you have requested.

The above supplemental materials are provided in addition to the supplemental wetland delineation information provided on October 22, 2020 and as summarized below:

- Wetland Delineation Memorandum dated October 19, 2020
- MassDEP Bordering Vegetated Wetland Delineation Field Data Forms (5)
- Existing Environmental Resources Plan revised October 22, 2020

Engineers
Environmental Scientists
Custom Software Developers
Landscape Architects
Planners
Surveyors



Christian Klein  
September 28, 2020  
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This information is also being transmitted electronically to the Conservation Commission and BETA Group. Please let us know if any hard copies are required. Our team is available to meet with BETA Group to present the supplemental materials. Please me call at 781-710-7280 or email me at [jhession@bscgroup.com](mailto:jhession@bscgroup.com) if you have any questions or require additional information.

Very truly yours,

BSC Group, Inc.

A handwritten signature in black ink.

John Hession, P.E.  
Director of Land Development

cc: zba@town.arlington.ma.us  
Richard Vallarelli, ZBA  
Emily Sullivan, Conservation  
Susan Chapnick, Conservation Commission  
Jenny Raitt, Planning and Community Development  
Marta Nover and Todd Undzis, BETA  
Stephanie Kiefer, Smolak & Vaughan  
Gwen Noyes and Arthur Klipfel, Arlington Land Realty

## THORNDIKE PLACE

### List of Requested Waivers

As required under 760 CMR 56.05(2)(h), the following is a list of Waivers to “Local Requirements and Regulations,” including waivers from the Bylaws of the Town of Arlington (the “Bylaws”), including the Town of Arlington Zoning Bylaw, as amended (the “Zoning Bylaw”), and other Local Requirements and Regulations as defined under 760 CMR 56.02 of the Chapter 40B Regulations, including all local legislative, regulatory, or other actions which are more restrictive than state requirements, if any, including local zoning and wetlands ordinances, subdivision and board of health rules, and other local ordinances, codes, and regulations, in each case which are in effect on the date of the Project’s application to the Board. In addition to the following list of requested Waivers listed below, the Applicant requests an exception from such provision or requirement of all Local Requirements and Regulations issued by a “Local Board” (defined under the Chapter 40B Regulations as means any local board or official, including, but not limited to any board of survey; board of health; planning board; conservation commission; historical commission; water, sewer, or other commission or district; fire, police, traffic, or other department; building inspector or similar official or board; city council, as well as all boards, regardless of their geographical jurisdiction or their source of authority [that is, including boards created by special acts of the legislature or by other legislative action] if such local board perform functions usually performed by locally created boards).

Pursuant to Chapter 40B rules described under 760 CMR 56.05(7), “[z]oning waivers are required solely from the “as-of-right” requirements of a zoning district where the project is located; there shall be no requirement to obtain waivers from the special permit requirements of the district.” Accordingly, any waivers which reference special permit requirements are included only for illustration purposes.

This waiver list continues to be preliminary and, as such, will be revised within the Public Hearing. Prior to the Board’s vote on the Comprehensive Permit application, a final waiver list shall be submitted and reflect waivers consistent with plans as revised within hearing process.

### LIST OF WAIVERS/EXCEPTIONS

<b>A. BY-LAWS OF THE TOWN OF ARLINGTON, MASSACHUSETTS (GENERAL BYLAWS)</b>				
<b>BY-LAW/REG.</b>	<b>TITLE</b>	<b>DESCRIPTION</b>	<b>REQUIRED</b>	<b>PROPOSED</b>
Title III: Article I, Sections 1 and 2	Use of Streets for Construction or Demolition Materials	Work adjacent to public ways and use of ways to place building materials or rubbish, and related application and fee requirements.	Application, permits from Board of Public Works (or Town Engineer), bond and bond requirements.	Waiver, except that Applicant shall comply with all bonding requirements.
Title III: Article I, Section 20	Excavation in Streets and Sidewalks	Work in public ways, excavation and related application and fee requirements	Application, permits and fee.	Waiver of permit and 25% of fees.

Thorndike Place (Arlington)				
Title V: Article 8 and Town Wetland Protection Regulations	Wetland Protection By-Law; Wetland Regulations of the Town of Arlington Conservation Commission (dated June 4, 2015)	Local Wetlands Bylaw and Related Regulations and Fees.	<p>Procedures, jurisdictional requirements, applications, fees, costs, regulations, policies, and enforcement, consultant fees.</p> <p>Section 23: Subpart C: No activity within bordering land subject to flooding without written permission of Commission Subpart D: Compensatory flood storage to be at 2:1 ratio.</p> <p>Section 24: Provides vegetation in a resource area shall not be damaged, removed, extensively pruned without written approval and in-kind replacement.</p> <p>Section 25, Subpart D – work in outer 75 feet of AURA (Restricted Zone) to be subject to alternatives analysis.</p>	<p>Waived as may be necessary under Section 23; Section 24 and Section 25, Subpart D, to the extent that such may differ from Wetlands Protection Act requirements Project to be governed by a Wetlands Order of Conditions issued pursuant to the Massachusetts Wetlands Protection Act (MGL c. 131, s. 40) and State Wetlands Regulations at 310 CMR 10.00</p> <p>Floodplain compensatory storage to be established at ratio of 2:1 – No waiver</p> <p>Replacement vegetation to be governed by landscaping plan included with Site Plans and governed by Comprehensive Permit.</p> <p>As depicted on Site Plans, small portion of exterior emergency access and limited area of subsurface parking within limited portion of outer AURA.. Waiver as to alternatives analysis.</p>
Title V; Article 8, Section 16.B.11	Wetlands Consultant Fees	Consultant Fees		Waived

Thorndike Place (Arlington)

Title V: Article 15, Section 1-5	Stormwater Mitigation	Stormwater Management and permitting	Procedures, applications, Engineering Division review and approval, relief from DPW	Waived.. Stormwater will be managed in accordance with the MassDEP's Stormwater Policy and Technical Guidance, unless otherwise exempt. Stormwater to also be managed in accordance with a US EPA Stormwater Construction Permit for Massachusetts.
Title IX: Article 3, Sections 4A, 4B	Town Fees and Charges, Department of Community Safety and Office of Building Inspector.	Fees and charges.	Payment of fees related to fire safety, building permits, plan reviews, occupancy permits, plumbing permit, gas fitting, electrical	Waiver allowing for 25% reduction of fees (reflecting 25% of project as affordable).
Water Connection Fee Regulations	Water Privilege Fee	Fee for water connections		Waiver requested of 25% of fee (reflecting 25% of project as affordable).
Sewer Privilege Fee	Sewer Privilege Fee	Fee for connection to public sewer system		Waiver requested of 25% of fee (reflecting 25% of project as affordable).

<b>B. TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)</b>				
<u>BY-LAW/REG.</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Article 2	Definitions	Various definitions.	Various definitions applying to provisions under bylaws.	Waived in its entirety to the extent definitions vary and/or conflict with MGL c. 40B and the Site Plans.
Article 4.02	Application	Application of Zoning Bylaw	Except as herein provided, provisions of the [Zoning] Bylaw shall apply to the erection, construction, reconstruction, alteration or use of buildings, structures, use of land.	Waived; erection and construction of multifamily residential dwelling together with accessory uses thereto, including without limitation accessory parking (surface and underground), play area, terraces, landscaping and management office to be governed by Comprehensive Permit Decision.
Article 5, Sec. 5.01	Use Regulations	Applicability	Buildings, structures or land shall be used only as set forth in Article 5.	Waived so that the use of buildings, structures or land for multifamily residential dwelling and accessory uses thereto shall be used in accordance with Comprehensive Permit decision pursuant to G.L.c.40B.
Article 5, Sections 5.03, 5.04	Use Regulations	Uses subject to other regulations and Table of Use Regulations	Table at Section 5.04 permits as of right uses for single-family detached and two family, duplex house. Other residential uses, including apartment house, permitted by special permit; requires special permit for other accessory use customarily incidental to a permitted principal use. .	Waived to allow 176-unit multifamily residential uses, open space and residential accessory uses (e.g., residential auto and bicycle parking, play area, terraces, landscaping, management office) and signage in PUD District, to be governed by Comprehensive Permit decision pursuant to G.L. c.40B.

<b>TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)</b>				<b>(cont.)</b>
<u>BY-LAW/REG.</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
<b>ARTICLE 6 – GENERAL REGULATIONS</b>				
Article 6, Section 6.00 – Table of Dimensional and Density Regulations	Dimensional and Density Regulations	Table of Dimensional and Density Regulations	Regulates minimum lot size, frontage; maximum floor area; maximum lot coverage; min. lot area, lot depth (front, side and rear); maximum heights, minimum landscaped areas and usable open space.	Waived to allow Project to be constructed in accordance with dimensional requirements of zoning ordinance in PUD district except as waived herein and depicted on approved plans described within Comprehensive Permit decision.

Thorndike Place (Arlington)

TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				(cont.)
BY-LAW/REG.	TITLE	DESCRIPTION	REQUIRED	PROPOSED
Article 6, Sections 6.01, 6.03(a) and Table of Dimensional and Density Regulations, generally and applicable to PUD District (p.61 of zoning bylaw), and Sections 6.13, 6.21, 6.28	General (Dimensional and Density) Regulations and Table; Reduced Height Limits in Height Buffer Area; Planned Unit Development Yards and Setbacks	Lot Areas and Separation of Lots; spacing of a residential building on the same lot with another principal building; in PUD district establishes a lower (40') building height on parts of lot within defined height area buffer, with greater height allowed by special permit; and sets out setbacks to street lines and front, rear, side lot lines	PUD dimensional requirements: <ul style="list-style-type: none"> <li>• 200,000 min. lot size;</li> <li>• .80 max FAR;</li> <li>• Max height: 85' (Residential uses to be no more than 5 floors)'</li> <li>• Minimum open space requirement in PUD of 10% landscaped and 10% usable;</li> <li>• Front, Side Rear Yards – 25' setback.</li> </ul>	<ul style="list-style-type: none"> <li>- Lot size = 769,359 SF – no waiver</li> <li>- FAR = .25 – no waiver</li> <li>- Height &lt;85'/ 4 floors + garage. – no waiver</li> <li>- 41.3% landscaped open space – no waiver</li> <li>- 10.6% usable open space – no waiver</li> <li>- First yard: 25' – no waiver</li> <li>- Side yard: 36' – no waiver</li> <li>- Rear yard – 20.5' – to be waived.</li> </ul>
-	Buildings in Floodplains	Dimensional and density regulations together with additional regulations of Section 11.04	Includes regulations within Section 6 and Section 11.04	Waived to the extent not consistent with Site Plans
Article 6, Section 6.10	Sale or Lease of Lots in a Planned Unit Development	Upon completion of environmental design review, tracts of land of at least 30,000 sf may be leased or sold for development in accordance with PUD site plan	Requires tracts within PUD development to have principal building, offstreet parking, open space or plaza as required as result of environmental design review under Section 11.06 of Bylaw.	Waiver of provisions, consistent with waiver of Section 11.06 environmental design review process; project to be governed by Comprehensive Permit decision and incorporated plans therein

Thorndike Place (Arlington)

TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				(cont.)
<u>BY-LAW/REG.</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Article 6, Section 6.30	Open Space Regulations for Planned Unit Developments	Sets out minimum open space within PUD district for apartment uses	Minimum open space for apartments in PUD district is 10% landscaped/10% usable open space	41.3% landscaped open space – no waiver 10.6% usable open space – no waiver
<b><u>ARTICLE 8 – OFF STREET PARKING AND LOADING</u></b>				
Article 8, Section 8.12.a(3)	Parking/Loading space standards – Minimum access aisle widths	Establishes minimum aisle widths for off street parking spaces	Minimum 24' aisle width of 90 deg angle parking	No waiver
Article 8, Section 8.12(b)(3)	Parking/Loading space standards	Location of parking areas	Parking not to be within required front yard.	Waiver to allow for parking area off Dorothy Road as shown on Site Plans.
<b><u>ARTICLE 10: ADMINISTRATION AND ENFORCEMENT</u></b>				Waived. Project governed by Comprehensive Permit.
Article 10, Section 10.02	Permit Required	Permits issued only in compliance with zoning bylaw.	No permit shall be issued if the building, structure or lot as constructed or used would be in violation of any provision of the Bylaw	Waiver so that construction and use of buildings and land be in accordance with the Comprehensive Permit decision.
Article 10, Section 10.11	Special Permits	Special Permit process	Special Permit required under Bylaw for review by ZBA or ARB (under Section 11.06) to review applications for Special Permits, including set of findings at 10.11(a)(1) and includes a two-year time period to make use of special permit.	ZBA review to adhere to Chapter 40B and 760 CMR 56.00 review standards, provisions for lapse of permits and single board (ZBA) review for local permitting of Comprehensive Permit application.

<b>TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)</b>				<b>(cont.)</b>
<u>BY-LAW/REG.</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Article 10, Section 10.12	Variances	Variance review process	ZBA is empowered to grant variances of Bylaw in accordance with Section 10 of Chapter 40A.	Waiver; ZBA review to adhere to Chapter 40B and 760 CMR 56.00 review standards and to issue waivers of local regulation, bylaws or rules.
<b>ARTICLE 11 SPECIAL REGULATIONS</b>				
Article 11, Section 11.04(a)-(g)	Floodplain District	Governing regulations and special permit review by ZBA/ARB	Permit required for specific uses and structures; seeks to require compliance with Sections 11.04 and 11.05 of Bylaw and Wetlands Protection Bylaw (Title V, Art. 8 of Town Bylaws), in addition to State Law (MGL 131, 40) and State Regulations (310 CR 10.00) and State Building Code. Establishes special permit process for new buildings or earth movement in floodplain.	Waiver for special permit process/environmental design review and waiver of application of local wetlands bylaw (Title 5 of Article 8), rules or regulations and Section 11.05 of Zoning Bylaw.  Project to be governed by Comprehensive Permit.
Article 11, Section 11.05(b), (d), (e), (f)	Inland Wetland District	Permit required for specific uses and structures.	Special Permit required for specific uses and structures.	To extent portions of property are within district, waiver given as Project governed by Comprehensive Permit. (For informational purposes, per 40B waivers are not required for special permit uses).

<b>TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)</b>				<b>(cont.)</b>
<u>BY-LAW/REG.</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Article 11, Section 11.06(b), Section 11.06(d)(1), (4), (5), (6), and 11.06(e) and 11.06(f)	Environmental Design Review	Environmental design review and standards for projects including six or more dwelling units (11.06(b)(1)(b) or use within a PUD (Section 11.06(b)(2).	Uses subject to Section 11.06(b) may be allowed subject to special permit upon application to ARB to include materials set out in Section 11.06(d) as well as certified land surveyor survey plan of land and corner points of lot to be marked by monument or other physical demarcation. Before special permit to issue, public hearing before ARB. Review standards as contained in Section 11.06(f).	Waiver of Environmental Design Review (EDR), special permit application submittal, standards, and hearings before ARB. Waiver to include waiver from adherence to EDR submittal requirements of Section 11.06(d) and review standards of Section 11.06(e)/(f). Applicant proposes to submit to ZBA within review of Comprehensive Permit application modeling for project; waiver of environmental impact statement; waiver of sign applications; signage to comply with zoning bylaw and are to be depicted on final approved site plans, with exception of temporary construction signage as approved by Building Official from time of commencement of project to completion of construction.. Project review to be accordance with public hearing process as established under MGL c.40B and its regulations at 760 CMR 56.00 et seq.; project to be governed by Comprehensive Permit decision.

TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				(cont.)
BY-LAW/REG.	TITLE	DESCRIPTION	REQUIRED	PROPOSED
Article 11, Section 11.07	Filling of Any Water or Wet Area	Filing submission requirements, review and standards within Environmental Design Review involving fill of water or wet areas of 500 cubic yards or greater or where area involved is >10,000 sq. ft. and approved under State WPA	Conditions on filing requirements and fill standards/limits.	Waiver to forego preparation of plans/documents for separate review. To the extent project requires submission of Notice of Intent under State WPA to the Arlington Conservation Commission; standards and criteria applicable are those contained in State Act and its regulations.
Article 11, Section 11.08	Affordable Housing Requirements	Affordable housing requirements for projects including six or more residential units under Section 1..06	Requires 15% of new residential units be Affordable Units (as defined in Zoning Bylaw, Section 11.08), or contribution to Affordable Housing Trust Fund, by allowance of ARB	Waiver to the extent Section 11.08 varies or is not consistent with Chapter 40B, its regulations and the rules and policies of DHCD and MassHousing. Applicant's project is subject to affordable housing requirements as contained in M.G.L. c.40B and its regulations under the New England Fund Program of Home Loan Bank of Boston, in accordance with Site Approval given by MassHousing and Regulatory Agreement approved by the State.

<b>ZONING BOARD OF APPEALS OF TOWN OF ARLINGTON COMPREHENSIVE PERMIT REGULATIONS</b>				
<u>REGULATION</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Section 3.1, 3.2	Application and Documentation	Application contents	Complete application filed upon submittal of documentation of Section 3.0	Waiver of certain submission requirements beyond the requirements of 760 CMR 56.00 at time of initial filing; additional documentation to be submitted to Board within public hearing process and review by peer review consultants.
Section 3.2.7	Preliminary Scaled Architectural Drawings	Preliminary Architectural	To be on scale of 1/8"=1"; include typical floor plans, typical elevations and sections; construction type and finish and signed by architect;	Waiver sought for scale of 1/8"=1" for all architectural drawings, due to size of area plans scaled at 1/8" would be too large to be useful.
Section 3.2.11	List of Requested Exemptions	Local Bylaw waivers	List of Exemptions to contain location on plan, complete explanation as to economic impact of local rule or regulation	Waiver sought to extent local regulation seeks "complete explanation as to economic impact," as such request is inconsistent with MGL c.40B/760 CMR 56.05(7) (waivers may be sought as consistent with local needs; where town has less than 10% affordable housing, presumption that affordable housing need outweighs local concerns.)

Thorndike Place (Arlington)

Section 3.2.13	Impact Analysis of the Natural and Built Environment	Impact analysis to be prepared by wetland scientist, environmental scientist, hydrologist, professional engineer, soil scientist, botanist, hydrogeologist or other scientific professional	Impact analysis by professional to assess predevelopment conditions and post-development impacts water quantity/quality; recharge, open space/recreational land; wildlife habitat and wetland resources; species of special concern and historic/ cultural resources	Waiver for timing of filing impact analysis at initial filing and to be supplemented to the Board within the public hearing process as reflected in 9/25/20 Response Supplemental Completeness Review .
Section 3.2.15	Statement of Impact on Municipal Facilities and Services	Applicant to provide impact analysis	Detailed analyses of costs imposed on Town as well as anticipated tax and other revenue to be generated	Waiver of impact analysis at initial filing; Applicant agrees to timely provide the same within the public hearing process for review by Board and its consultant, as project may be further refined within public hearing process and process as reflected in 9/25/20 Response to Supplemental Completeness Review.

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To: Arlington Zoning Board of Appeals  
Fr: Stephanie A. Kiefer, Esq.  
Re: Narrative Report on Existing Site Condition - Thorndike Place  
Date: November 3, 2020

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The below narrative report on Existing Site Conditions supplements the Site Conditions Report (Part III) of Arlington Land Realty, LLC's Comprehensive Permit, previously filed with the Zoning Board on September 2, 2016. Under Section 3.2.6 of the Arlington Comprehensive Permit regulations, a report (together with applicable plans) is requested to describe existing site conditions, summarize conditions in the surrounding area, wetland or vernal pools, mature trees, existing street elevations, traffic patterns and character of open areas in the neighborhood.

A. Site Location

The Mugar property, approximately 17+ acres in size, is a largely forested site located in East Arlington, between Route 2/Concord Turnpike and residential neighborhoods to the north and east and Thorndike athletic fields to the south. The locus is accessed via Dorothy Road, a 40-foot public way, as well as the intersecting Parker Street and Littlejohn Street. To the east, Edith Street and Burch Street access the site.

The locus is within Arlington's PUD zoning district, which zoning district specifically contemplates use of the land for larger scale developments, including higher density apartment house residential uses. The majority of the adjacent neighborhood, including abutting properties on Dorothy Road, Burch Street and Edith Street, is located in the R2 Two-Family zoning district. The portion of the neighborhood east of Littlejohn Street and north to Lake Street is within the R1 – Single-Family zoning district. Locations of existing structures and existing public roadways in the immediate vicinity of the Site are shown on the Existing Conditions Plan. There are no existing buildings located on the Mugar property.

The location of the property is well situated to both subway, bus and bike paths, to make the project a highly transit-friendly residential project. Likewise, given the size of the property, the property can support the proposed multifamily residential use while also allowing for a large portion of the site to be protected under a conservation restriction.

The MBTA Alewife Station is approximately .5 mile from the site; the Alewife station services the Red Line subway line as well as a number of MBTA bus routes, including Route 62, Route 67, Route 76, Route 79, Route 84, Route 350 and Route 351. Directly to the south of the property is Route 2/Concord Turnpike. Route 2 is classified by the MassDOT as a Principal

Arterial under MassDOT jurisdiction. Route 2 connects various towns and major highways from the New York State line to Boston. Locally, Route 2 provides a connection between I-95/Route 128 to the west with Route 16 to the east.

B. Existing Conditions of the Site

The topography of the site is undulating with small to medium sized depressions in the northeasterly portion of the property. To the north, along Dorothy Road, site elevations range from 8 to 12 feet; and the frontage along Route 2/Concord Turnpike is generally between elevation 5 to 8 feet.

The property is largely forested, with extensive areas overrun with invasive species including Garlic Mustard, Japanese Knotweed, and Oriental Bittersweet. (*See* Wildlife Habitat and Vegetation Evaluation for a more detailed description of the existing vegetation). The soils onsite are generally decomposed organic material over loose sandy and gravelly glaciofluvial deposit. The property is presently undeveloped and overgrown, with makeshift homeless camps upon the site.

The Existing Conditions Plan (Sheet V-100) prepared by the BSC Group depicts the site location, the abutting properties, existing street elevations and other relevant information with respect to the existing condition of the property, including without limitation location of buildings on adjacent properties. Please also refer to the General Notes and Utility Note on the Existing Condition Plan for further information.

C. Character of Open Areas in Vicinity

The site is presently undeveloped. The immediate neighborhood to the north and east is densely residentially developed. To the west of the site are the Thorndike athletic fields.

As part of Applicant's proposal, only the northerly/northwesterly portion of the site is proposed for the multifamily housing project and its accessory driveway access, landscaping, play area, terraces and related infrastructure. The Applicant has proposed that the environmentally sensitive portions of the site be protected by a conservation restriction or other appropriate land conservation mechanism.

D. Locations of Wetland Resource Areas and Floodplain Features

A large portion of the site is located within floodplain area and Bordering Vegetated Wetland, located predominantly on the southerly side of the site, both of which are wetland resource areas under the State Wetlands Protection Act Regulations and the Arlington Wetlands Protection Bylaw. The 100-year floodplain is identified as elevation 6.8 and has been located on the Existing Conditions and Existing Environmental Resources Plans (Sheets V-100 and C-100 in the plan set). The wetlands were delineated by BSC Group in January 2020 and again in October 2020. The wetland resource areas are shown on the Existing Environmental Resources

Plan (Sheet C-100 in the plan set) and as further documented in a Wetland Delineation Memorandum prepared by BSC Group dated October 19, 2020.

A review of the information available through MassGIS and the Natural Heritage and Endangered Species on-line data viewer determined no presence of estimated or priority habitat area, vernal pools, or any other similar jurisdictional resource area (*See* Wildlife Habitat and Vegetation Evaluation for a more detailed description of the existing wildlife).

The Existing Environmental Resources Plan (Sheet C-100) shows the locations of wetland resource areas and floodplain as surveyed and delineated by the BSC Group. The wetland resource areas are also further detailed in the BSC Group Wetlands Delineation Memorandum, dated October 19, 2020. A copy of the October 19, 2020 memorandum was previously submitted to the Board on October 22, 2020. The BSC memorandum describes both the state and locally regulated wetland resource areas and buffer zones and floodplain areas. As detailed therein, BSC delineated and flagged four Bordering Vegetated Wetland ("BVW") mapped areas, BVW Series A-D. BVW Series A and D are predominantly forested areas; BVW Series B is primarily forested with an area of herbaceous cover and BVW Series C is largely herabaceous cover (common reed) with some forested area. According to BSC's observations, only a small isolated area to the west of an area previously flagged as Wetland I on the north side of the site demonstrated hydric soils. The BSC memorandum also identifies the tree species located on the property as well as the shrub and sapling species, herbaceous species and vines. As documented by BSC's field investigations, the upland areas, the tree population includes red oak, white pine, cottonwood, box elder and red maple

Further, please refer to the Wildlife Habitat and Vegetation Evaluation report submitted herewith for further detailed information on the existing vegetation, wildlife and documented conditions on the property. The Wildlife Habitat and Vegetation report documents a number of mature trees in the study areas, but has not conducted a full tree survey within the heavily wooded site.

#### E. Traffic and Parking

The Thorndike Place 40B project is designed to leverage its proximity to a major bike path (Minuteman Bike Path) as well as nearby transportation facilities to encourage multi-modal travel. Primary access to the 176-unit multifamily project will be at the corner of the Dorothy Road/Littlejohn Street. The detailed updated traffic impact report is being submitted to the Board under separate cover by Vanasse & Associates, which will detail the existing traffic patterns together with an analysis of the traffic presently existing and as impacted by the 40B project.

The Arlington Zoning Ordinance requires one parking space per studio apartment, 1.15 spaces per one-bedroom unit, 1.5 spaces per two-bedroom unit and 2.0 spaces per three-bedroom unit in an apartment house. The Project includes a total of 240 parking spaces in accordance with the zoning requirements, or an average of 1.36 spaces per unit which is a parking space per unit ratio generally consistent with projects of this nature. The Project also includes approximately 140 bicycle parking spaces.

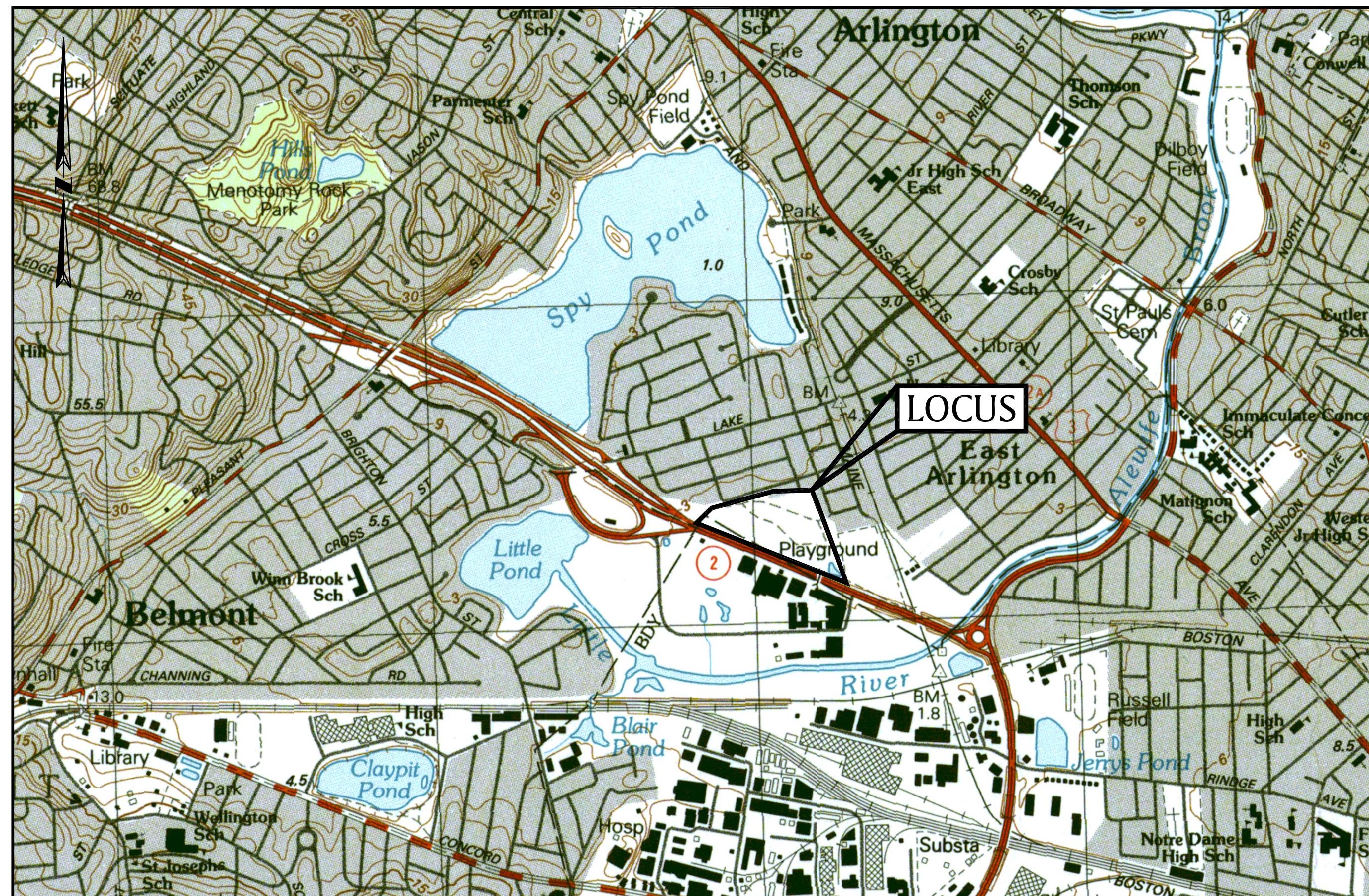


# THORNDIKE PLACE COMPREHENSIVE PERMIT

## DOROTHY ROAD ARLINGTON, MASSACHUSETTS

MARCH 13, 2020

REVISED: NOVEMBER 3, 2020



PREPARED FOR:

ARLINGTON LAND REALTY, LLC  
84 SHERMAN STREET, 2ND FLOOR  
CAMBRIDGE, MA 02140

ISSUED FOR PERMITTING  
NOT FOR CONSTRUCTION

## INDEX OF DRAWINGS

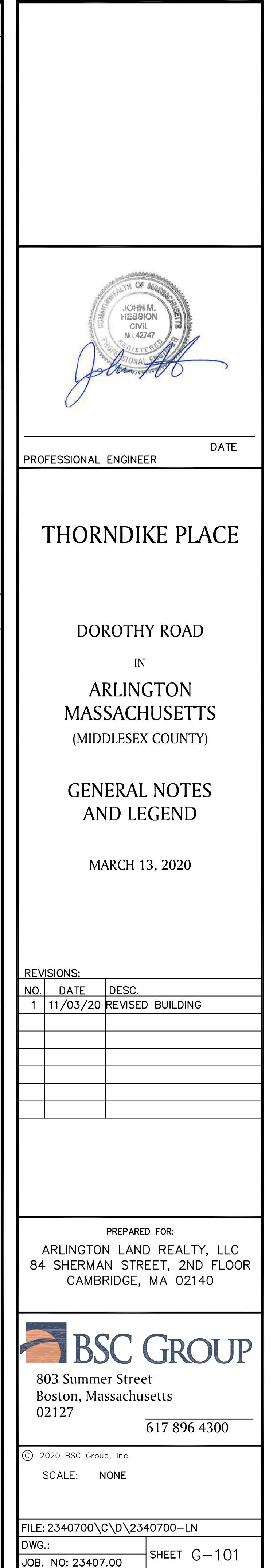
- G-100 TITLE SHEET
- G-101 GENERAL NOTES & LEGEND
- V-100 EXISTING CONDITIONS PLAN
- C-100 EXISTING ENVIRONMENTAL RESOURCE PLAN
- C-101 SITE PREPARATION PLAN
- C-102 OVERALL SITE PLAN
- C-103 LAYOUT & MATERIALS PLAN
- C-104 GARAGE LEVEL PLAN
- C-105 GRADING & DRAINAGE PLAN
- C-106 UTILITY PLAN
- L-100 PLANTING PLAN
- C-200-203 CIVIL & LANDSCAPE DETAILS

PREPARED BY:



**BSC GROUP**  
803 Summer Street  
Boston, Massachusetts  
02127  
617 896 4300

<p><b>GENERAL NOTES</b></p> <ol style="list-style-type: none"> <li>EXISTING CONDITIONS SURVEY INFORMATION WAS PREPARED BY BSC GROUP, INC. SURVEY IS BASED ON AN ON-THE-GROUND SURVEY CONDUCTED BY BSC GROUP IN DECEMBER 2019-FEBRUARY 2020.</li> <li>REVIEW ALL EXISTING CONDITIONS IN THE FIELD AND REPORT ANY DISCREPANCIES BETWEEN PLANS AND ACTUAL CONDITIONS TO THE OWNER'S REPRESENTATIVE PRIOR TO STARTING WORK.</li> <li>THE LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THIS PLAN ARE BASED ON THE SURVEY REFERENCED ABOVE. THE CONTRACTOR SHALL CONTACT DIGSAFE AND THE PROPER LOCAL AUTHORITIES OR RESPECTIVE UTILITY COMPANIES TO CONFIRM THE LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. ANY DAMAGE DUE TO FAILURE OF THE CONTRACTOR TO CONTACT THE PROPER AUTHORITIES SHALL BE BORNE BY THE CONTRACTOR.</li> <li>ANY DISCREPANCIES BETWEEN DRAWINGS, SPECIFICATIONS, AND SITE CONDITIONS SHALL BE REPORTED IMMEDIATELY TO THE CONTRACTOR/ENGINEER FOR CLARIFICATION AND RESOLUTION PRIOR TO BIDDING OR CONSTRUCTION.</li> </ol> <p><b>SITE PREPARATION NOTES</b></p> <ol style="list-style-type: none"> <li>AREAS DESIGNATED FOR CLEARING SHALL BE CLEARED ONLY.</li> <li>THE SUBCONTRACTOR(S) IS/ARE RESPONSIBLE FOR ANY DAMAGE TO EXISTING CONDITIONS TO REMAIN THAT ARE DUE TO SUBCONTRACTOR(S) OPERATIONS.</li> <li>ITEMS TO BE REMOVED THAT ARE NOT STOCKPILED FOR LATER REUSE ON THE PROJECT OR DELIVERED TO THE OWNER SHALL BE LEGALLY DISPOSED OF OFF SITE BY THE SUBCONTRACTOR(S).</li> <li>THE SUBCONTRACTOR(S) SHALL BE RESPONSIBLE FOR COORDINATING THEIR EFFORTS WITH ALL TRADES.</li> <li>THE CONTRACTOR SHALL COORDINATE ALL ADJUSTMENT OR ABANDONMENT OF UTILITIES WITH THE RESPECTIVE UTILITY COMPANY.</li> <li>THE SUBCONTRACTOR(S) SHALL MAINTAIN OR ADJUST TO NEW FINISH GRADE AS NECESSARY ALL UTILITY AND SITE STRUCTURES SUCH AS LIGHT POLES, SIGN POLES, MAN HOLES, CATCH BASINS, HOLE HOLES, WATER AND GAS GATES, HYDRANTS, ETC., FROM MAINTAINED UTILITY AND SITE SYSTEMS UNLESS OTHERWISE NOTED OR DIRECTED BY THE CONTRACTOR/ENGINEER.</li> <li>TOTAL CONSTRUCTION HAUL ROADS (IF REQUIRED) SHALL BE EXCAVATED AND THE SUB-BASE COMPAKTED TO 95% SPMD. THE USE OF SEPARATION FABRICS MAY BE USED TO FACILITATE FUTURE REMOVAL AND RECOVERY OF GRANULAR MATERIALS. HAUL ROAD SHALL HAVE AT LEAST 9' OF 6-INCH MINUS STONE AND SHALL BE MAINTAINED DURING CONSTRUCTION.</li> </ol> <p><b>EROSION AND SEDIMENT CONTROL MEASURES</b></p> <ol style="list-style-type: none"> <li>EROSION CONTROL SHALL BE PROVIDED IN ACCORDANCE WITH THE SEQUENCE OF STAGED CONSTRUCTION. THE CONTRACTOR SHALL SUBMIT A DETAILED EROSION CONTROL PLAN INCLUDING SCHEDULE FOR APPROVAL BY THE TOWN OF ARLINGTON. A COPY OF THE APPROVED NPDES - EROSION AND SEDIMENT CONTROL PLAN SHALL BE MAINTAINED ON THE SITE.</li> <li>ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO ANY SITE EXCAVATION OR DISTURBANCE AND SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PROCESS. THE SMALLEST PRACTICAL AREA OF LAND SHALL BE EXPOSED AT ANY ONE TIME.</li> <li>SEDIMENT TRAPS SHALL BE INSTALLED AT DRAINAGE STRUCTURES IN PUBLIC STREET IN THE PROJECT AREA. STRAW BALES AND SILTATION FENCES ARE TO BE MAINTAINED AND CLEANED UNTIL ALL SLOPES HAVE BEEN STABILIZED.</li> <li>SEDIMENT BARRIERS SHALL BE INSPECTED AND APPROVED BY THE TOWN OF ARLINGTON BEFORE CONSTRUCTION CAN START.</li> <li>STRAW BALES AND MULCH SHALL BE MOWINGS OF ACCEPTABLE HERBACEOUS GROWTH, FREE OF NOXIOUS WEEDS OR WOODY STEMS, AND SHALL BE DRY WHEN INSTALLED.</li> <li>THE UNDERSIDE OF STRAW BALES SHOULD BE KEPT IN CLOSE CONTACT (TRENCHED IN 3-INCHES MINIMUM) WITH THE EARTH AND RESET AS NECESSARY.</li> <li>DISTURBED AREAS SHALL BE BLANKETED OR SEEDED AND MULCHED AS SOON AS PRACTICAL AFTER CONSTRUCTION ACTIVITIES IN THAT AREA HAVE CONCLUDED. ALL ERODABLE/BARE AREAS SHALL BE BLANKETED OR SEEDED AND MULCHED WITHIN 7 DAYS WITH TEMPORARY EROSION CONTROL SEEDING.</li> <li>STABILIZE SLOPES GREATER THAN 3:1 (HORIZONTAL-VERTICAL) WITH SEED, SECURED GEOTEXTILE FABRIC, SPRAYED COMPOST BLANKET, OR RIP-RAP AS REQUIRED TO PREVENT EROSION DURING CONSTRUCTION.</li> <li>SEDIMENT BARRIERS SHALL BE CONSTRUCTED AROUND ALL SOIL STOCKPILE AREAS.</li> <li>CLEAN OUT DRAINAGE FEATURES AND STRUCTURES AFTER COMPLETION OF CONSTRUCTION.</li> <li>SEDIMENT COLLECTED DURING CONSTRUCTION BY THE VARIOUS TEMPORARY EROSION CONTROL SYSTEMS SHALL BE DISPOSED OF ON THE SITE ON A REGULAR BASIS. SEDIMENT SHALL BE REMOVED FROM EROSION CONTROL SYSTEMS WHEN THE HEIGHT OF THE SEDIMENT EXCEEDS ONE-HALF OF THE HEIGHT OF THE SEDIMENT CONTROL MEASURE.</li> <li>AFTER ALL DISTURBED AREAS HAVE BEEN STABILIZED, THE SUBCONTRACTOR(S) SHALL REMOVE ALL TEMPORARY EROSION CONTROL MEASURES AT THE CONTRACTOR/ENGINEER DIRECTION.</li> <li>AFTER THE REMOVAL OF TEMPORARY EROSION CONTROL MEASURES, THE SUBCONTRACTOR(S) SHALL GRADE AND SEED AREA OF TEMPORARY EROSION CONTROL MEASURE.</li> <li>DAMAGED OR DETERIORATED ITEMS WILL BE REPAIRED IMMEDIATELY AFTER IDENTIFICATION OR AS DIRECTED BY THE CONTRACTOR/ENGINEER.</li> <li>THE CONTRACTOR'S SITE SUPERINTENDENT WILL BE RESPONSIBLE FOR DAILY INSPECTIONS, MAINTENANCE, AND REPAIR ACTIVITIES. THE CONTRACTOR SHALL INSPECT EROSION CONTROL MEASURES EVERY SEVEN (7) CALENDAR DAYS OR QUITE EVERY FOURTEEN (14) DAYS AND WITHIN 24 HOURS OF ANY STORM EXCEEDING 1/2 INCH PRECIPITATION. DAMAGED AND INEFFECTIVE EROSION CONTROL MEASURES SHALL BE REPAIRED OR REPLACED WITHIN 48 HOURS.</li> <li>PIPE OUTLETS (IF ANY) SHALL BE STABILIZED WITH STONE.</li> <li>TEMPORARY SEEDING SHALL BE AT A RATE OF 45 LBS PER ACRE. ERODABLE AREAS OUTSIDE AND DOWN SLOPES FROM THE CONSTRUCTION LIMITS SHALL BE SIMILARLY SEDED.</li> <li>WATER PUMPED OR OTHERWISE DISCHARGED FROM THE SITE DURING CONSTRUCTION Dewatering SHALL BE FILTERED. Dewatering PLAN SHALL BE SUBMITTED FOR APPROVAL BY THE ENGINEER.</li> <li>WHEN TEMPORARY DRAINAGE IS ESTABLISHED, EROSION/SEDIMENTATION CONTROL MEASURES MAY BE REQUIRED BY CONTRACTOR/ENGINEER.</li> <li>GRAVEL CONSTRUCTION ROADS AND CONSTRUCTION PARKING AREAS OF SUFFICIENT WIDTH AND LENGTH, AND VEHICLE WASH DOWN FACILITIES, SHALL BE PROVIDED TO PREVENT SOIL FROM BEING TRACKED onto PUBLIC OR PRIVATE ROADWAYS. ANY SOIL REACHING A PUBLIC OR PRIVATE ROADWAY SHALL BE REMOVED BEFORE THE END OF EACH WORKDAY AND AS NEEDED.</li> <li>NECESSARY MEASURES SHALL BE TAKEN TO CONTAIN ANY FUEL OR POLLUTION RUNOFF. LEAKING EQUIPMENT OR SUPPLIES SHALL BE IMMEDIATELY REPAIRED OR REMOVED FROM THE SITE.</li> <li>THE COST OF REPAIRING OR REMOVING SEDIMENT FROM EROSION CONTROL SYSTEMS SHALL BE INCLUDED IN THE CONTRACT UNIT PRICE FOR THE APPLICABLE EROSION CONTROL ITEM.</li> <li>ALL EROSION CONTROL MEASURES SHALL BE KEPT OPERATIONAL AND MAINTAINED CONTINUOUSLY THROUGHOUT THE PERIOD OF LAND DISTURBANCE UNTIL PERMANENT SEDIMENT AND EROSION CONTROL MEASURES ARE OPERATIONAL. CONTRACTOR SHALL PROVIDE TO THE CONSERVATION COMMISSION MEASURES (EROSION AND SEDIMENTATION CONTROL) FOR WORK DURING WINTER CONDITIONS.</li> <li>CONTRACTOR SHALL SPRAY WATER FROM A WATER TRUCK ON DRY AND WINDY DAYS TO PREVENT DUST FROM FORMING.</li> <li>EROSION CONTROL MEASURES AS SHOWN ON THESE DRAWINGS IS INTENDED TO CONVEY MINIMUM REQUIREMENTS. THE CONTRACTOR SHALL IMPLEMENT ADDITIONAL MEASURES AS NECESSARY TO PREVENT SOIL EROSION AND TO COMPLY WITH THE PROJECT'S STORMWATER POLLUTION PREVENTION PLAN.</li> <li>SOILS ON SLOPES THAT ARE 3:1 OR STEEPER SHOULD BE ROUGHENED PER THE EPA'S NPDES SOIL ROUGHENING FACT SHEET IF THEY ARE TO BE SEADED WITHIN 2 WEEKS OF DISTURBANCE. IF NOT, EROSION</li> </ol>	<p>CONTROL BLANKETS SHOULD BE INSTALLED ON THESE SLOPES.</p> <p><b>LAYOUT AND MATERIAL NOTES</b></p> <ol style="list-style-type: none"> <li>THE FOLLOWING LAYOUT CRITERIA SHALL CONTROL UNLESS OTHERWISE NOTED ON THE PLAN:       <ol style="list-style-type: none"> <li>ALL TIES TO PROPERTY LINES ARE PERPENDICULAR TO THE PROPERTY LINE UNLESS OTHERWISE NOTED.</li> <li>DISTANCES AND DIMENSIONS ARE IN DECIMAL FEET.</li> </ol> </li> <li>SCREENED IMAGES SHOW EXISTING CONDITIONS. WHERE EXISTING CONDITIONS LIE UNDER OR ARE IMPINGED UPON BY PROPOSED BUILDINGS AND/OR SITE ELEMENTS, THE EXISTING CONDITION WILL BE REMOVED, ABANDONED AND/OR CAPPED OR DEMOLISHED AS REQUIRED. AMBIGUITIES IN THE PLANS SHALL BE CLARIFIED BY THE ENGINEER OR SITE SUPERINTENDENT.</li> </ol> <p><b>GRADING AND UTILITY NOTES</b></p> <ol style="list-style-type: none"> <li>THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE APPLICANT. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MAY BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ALL UNDERGROUND UTILITIES.</li> <li>THE PROJECT APPLICANT SHALL OBTAIN ALL NECESSARY STREET-OPENING PERMITS, WATER AND SEWER CONNECTION PERMITS AND PAY REQUIRED FEES PRIOR TO COMMENCING WORK ON THESE UTILITIES.</li> <li>WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY COORDINATION WITH THE TOWN OF ARLINGTON.</li> <li>ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF ALL GAS, ELECTRIC, TELEPHONE, AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY COMPANIES SHALL BE MADE BY THE PROJECT APPLICANT.</li> <li>AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONSTRUCTION SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.</li> <li>WHERE PROPOSED GRADES MEET EXISTING GRADES, SUBCONTRACTOR(S) SHALL BLEND GRADES TO PROVIDE A SMOOTH TRANSITION BETWEEN EXISTING AND NEW WORK. PONDING AT TRANSITION AREAS WILL NOT BE ALLOWED.</li> <li>POSITIVE DRAINAGE SHALL BE MAINTAINED AWAY FROM ALL STRUCTURES.</li> <li>SUBCONTRACTOR(S) SHALL VERIFY EXISTING GRADES AND NOTIFY THE CONTRACTOR/ENGINEER OF ANY DISCREPANCIES.</li> <li>PRIOR TO ANY WORK OVER EXISTING TOWN-OWNED UTILITIES, CONTRACTOR TO EVALUATE CONDITION OF SUBSURFACE UTILITIES PRIOR TO CONSTRUCTION. A POST-CONSTRUCTION EVALUATION SHALL ALSO BE PERFORMED TO IDENTIFY ANY DAMAGE CAUSED DURING CONSTRUCTION.</li> <li>ANY INSTALLATION OF UTILITY POLES OR UNDERGROUND CONDUIT WITHIN THE PUBLIC RIGHT-OF-WAY WILL REQUIRE A GRANT OF LOCATION FROM THE BOARD OF SELECTMEN.</li> </ol> <p><b>PLANTING NOTES</b></p> <ol style="list-style-type: none"> <li>MAINTENANCE SHALL BEGIN IMMEDIATELY AFTER PLANTING AND WILL CONTINUE UNTIL FINAL WRITTEN ACCEPTANCE OF PLANT MATERIAL.</li> <li>MAINTAIN POSITIVE DRAINAGE AWAY FROM ALL BUILDING FOUNDATIONS AND STRUCTURES.</li> <li>MAXIMUM SLOPE WITHIN DISTURBED AREAS SHALL NOT EXCEED 3:1, UNLESS OTHERWISE NOTED.</li> <li>THE LANDSCAPE CONTRACTOR SHALL SUPPLY ALL PLANT MATERIALS IN QUANTITIES SUFFICIENT TO COMPLETE PLANTINGS SHOWN ON THE DRAWINGS.</li> <li>MATERIALS SHALL CONFORM TO THE GUIDELINES ESTABLISHED BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION.</li> <li>PLANTS SHALL BEAR THE SAME RELATIONSHIP TO FINISH GRADE AS TO ORIGINAL GRADES BEFORE DIGGING.</li> <li>PLANTS TO BE BALLED IN BURLAP OR CONTAINERIZED.</li> <li>AREAS PLANTED WITH EVERGREEN TREES SHALL BE COVERED WITH A MINIMUM 3' OF MULCH. MULCH FOR PLANTED AREAS TO BE AGED PINE BARK; PARTIALLY DECOMPOSED, DARK BROWN IN COLOR AND FREE OF WOOD CHIPS THICKER THAN 1/4 INCH.</li> <li>THE LANDSCAPE CONTRACTOR SHALL GUARANTEE ALL PLANT MATERIALS FOR ONE (1) FULL YEAR FROM DATE OF ACCEPTANCE.</li> <li>PLANT MATERIALS ARE SUBJECT TO THE APPROVAL OF THE LANDSCAPE ARCHITECT, AT THE NURSERY, AND AT THE SITE.</li> <li>PLANT SPECIES AS INDICATED IN THE PLANT LIST ARE SUGGESTIONS ONLY. FINAL SELECTION OF SPECIES SHALL OCCUR AT THE TIME OF PLANT PURCHASE, DEPENDING ON AVAILABILITY. PLANT SIZE AND QUANTITY SHALL NOT CHANGE WITHOUT APPROVAL OF CONTRACTOR/LANDSCAPE ARCHITECT.</li> </ol>	<p><b>ABBREVIATIONS</b></p> <table border="0"> <tbody> <tr><td>BC</td><td>BOTTOM OF CURB</td></tr> <tr><td>BIT CONC</td><td>BITUMINOUS CONCRETE</td></tr> <tr><td>BVV</td><td>BORDERING VEGETATED WETLANDS</td></tr> <tr><td>CB</td><td>CATCH BASIN</td></tr> <tr><td>CB/DH</td><td>CONC. 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SCALE: NONE</p> <p>FILE: 2340700\CD\2340700-LN DWG.: JOB. NO: 23407.00 SHEET G-101</p>	BC	BOTTOM OF CURB	BIT CONC	BITUMINOUS CONCRETE	BVV	BORDERING VEGETATED WETLANDS	CB	CATCH BASIN	CB/DH	CONC. 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### PLAN REFERENCES

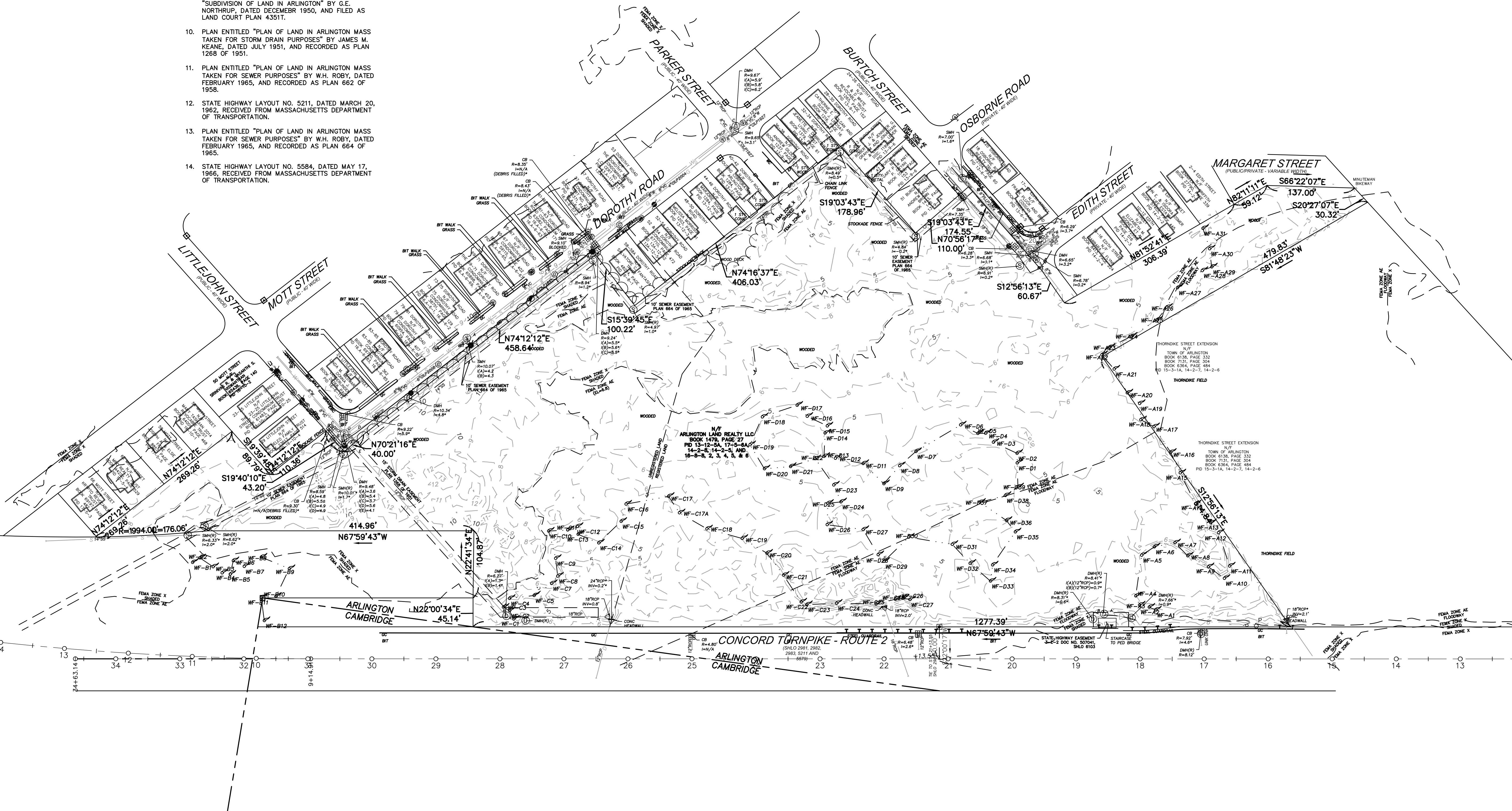
- PLAN ENTITLED "PLAN AND PROFILE OF LITTLEJOHN STREET" BY FRANK AND DANIEL WYMAN, DATED DECEMBER 1926, AND RECEIVED FROM THE TOWN OF ARLINGTON.
- PLAN ENTITLED "SUBDIVISION OF LAND IN ARLINGTON" BY BREMER W. POND, DATED APRIL 28, 1927, AND FILED AS LAND COURT PLAN 4351C.
- PLAN ENTITLED "SUBDIVISION OF LAND SHOWN ON PLAN 4351A" BY J.M. KEANE, DATED OCTOBER 20, 1930, AND FILED AS LAND COURT PLAN 4351G.
- PLAN ENTITLED "SUBDIVISION OF LAND SHOWN ON PLAN 4351A" BY J.M. KEANE, DATED APRIL 14, 1931, AND FILED AS LAND COURT PLAN 4351H.
- STATE HIGHWAY LAYOUT NO. 2981, DATED JANUARY 17, 1933, RECEIVED FROM MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.
- STATE HIGHWAY LAYOUT NO. 2983, DATED JANUARY 17, 1933, RECEIVED FROM MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.
- PLAN ENTITLED "PLAN OF LAND IN ARLINGTON, MASS." BY C. H. GANNETT CO. CIVIL ENGINEERS, DATED APRIL 30, 1941, AND FILED AS LAND COURT PLAN 18030A.
- PLAN ENTITLED "SUBDIVISION OF LAND IN ARLINGTON MASS" BY G.E. NORTHRUP, DATED DECEMBER 1948, AND RECORDED AS PLAN 1784 OF 1948.
- PLAN ENTITLED "SUBDIVISION OF LAND IN ARLINGTON" BY G.E. NORTHRUP, DATED DECEMBER 1950, AND FILED AS LAND COURT PLAN 4351P. PLAN ENTITLED "SUBDIVISION OF LAND IN ARLINGTON" BY G.E. NORTHRUP, DATED DECEMBER 1950, AND FILED AS LAND COURT PLAN 4351T.
- PLAN ENTITLED "PLAN OF LAND IN ARLINGTON MASS TAKEN FOR STORM DRAIN PURPOSES" BY JAMES M. KEANE, DATED JULY 1951, AND RECORDED AS PLAN 1268 OF 1951.
- PLAN ENTITLED "PLAN OF LAND IN ARLINGTON MASS TAKEN FOR SEWER PURPOSES" BY W.H. ROBY, DATED FEBRUARY 1965, AND RECORDED AS PLAN 662 OF 1958.
- STATE HIGHWAY LAYOUT NO. 5211, DATED MARCH 20, 1962, RECEIVED FROM MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.
- PLAN ENTITLED "PLAN OF LAND IN ARLINGTON MASS TAKEN FOR SEWER PURPOSES" BY W.H. ROBY, DATED FEBRUARY 1965, AND RECORDED AS PLAN 664 OF 1965.
- STATE HIGHWAY LAYOUT NO. 5584, DATED MAY 17, 1966, RECEIVED FROM MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.

### GENERAL NOTES

- THIS PLAN IS BASED UPON AN ON-THE-GROUND SURVEY PERFORMED BY BSC GROUP, INC. IN DECEMBER, 2019 AND 7. CONTOURS SHOWN WITHIN WOODED AREAS ARE BASED UPON AERIAL LIDAR COLLECTED UNDER USGS CONTRACT D14-19-0003-0014. DATA IS SUBJECT TO USGS SPECIFICATIONS. BSC GROUP FOUND A MEAN ERROR OF 0.20'(OBSCURED) & 0.16'(UNOBSCURED) ACROSS 15 LOCATIONS SAMPLED DURING THE ON-THE-GROUND SURVEY IN DECEMBER 2019.
- HORIZONTAL DATUM IS BASED UPON NAD '83 (12') AS DERIVED VIA GPS OBSERVATIONS PERFORMED BY BSC GROUP, INC. IN DECEMBER 2019.
- VERTICAL DATUM IS BASED UPON NAVD '88 AS DERIVED VIA GPS OBSERVATIONS PERFORMED BY BSC GROUP, INC. IN DECEMBER 2019.
- TOWN LINE LOCATIONS ESTABLISHED FROM MASSACHUSETTS STATE HIGHWAY LAYOUTS 2981, 2982, 2983, 5211 AND 5579.
- ABUTTING BOUNDARY LINES ARE APPROXIMATE.
- RECORD UTILITY INFORMATION WAS NOT RECEIVED FROM VERIZON, TENNESSEE GAS AND MCI.
- LOCUS IS LOCATED WITHIN ZONES ZONES AE, AF FLOODWAY, X AND X SHADED AS GRAPHICALLY DEPICTED ON FLOOD INSURANCE RATE MAP NUMBER 25017C0419E, EFFECTIVE DATE JUNE 4, 2010.
- WETLAND RESOURCE AREAS SHOWN HEREON WERE DELINEATED BY BSC GROUP, INC. IN JANUARY AND OCTOBER 2020.
- UTILITY RECORDS HEREON DENOTED WITH "\*" ARE FROM EXISTING CONDITIONS SURVEY PREPARED BY PRECISION LAND SURVEYING OF SOUTHBOROUGH, MA IN 2009.

### UTILITY NOTE

EXISTING UTILITIES, WHERE SHOWN HEREON, ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY LOCATING AND COORDINATING ANY ON-SITE ACTIVITY WITH DIG-SAFE AND THE APPROPRIATE UTILITY COMPANY AND MAINTAINING EXISTING UTILITY SYSTEM SERVICE. DIG-SAFE SHALL BE NOTIFIED PER THE CONTRACTOR'S DIGITAL MASS UTILITIES STANDARD OPERATING PROCEDURE SECTION 10, AT 888-344-7233. NO GUARANTEES IMPLIED OR INTENDED AS TO THE ACCURACY, LOCATION OR THAT ALL UTILITIES AND/OR SUBSURFACE STRUCTURES ARE SHOWN. THE CONTRACTOR SHALL VERIFY SIZE, LOCATION AND INVERTS OR UTILITIES AND STRUCTURES AS REQUIRED PRIOR TO THE START OF CONSTRUCTION.



THORNDIKE PLACE

DOROTHY ROAD

IN

ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

EXISTING  
CONDITIONS

MARCH 13, 2020

### REVISIONS:

NO.	DATE	DESC.
1	10/22/20	WETLAND DELINEATION

PREPARED FOR:  
ARLINGTON LAND REALTY, LLC  
84 SHERMAN STREET, 2ND FLOOR  
CAMBRIDGE, MA 02140

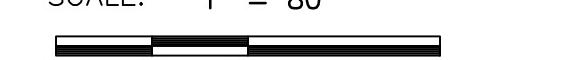
BSC GROUP

803 Summer Street  
Boston, Massachusetts  
02127

617 896 4300

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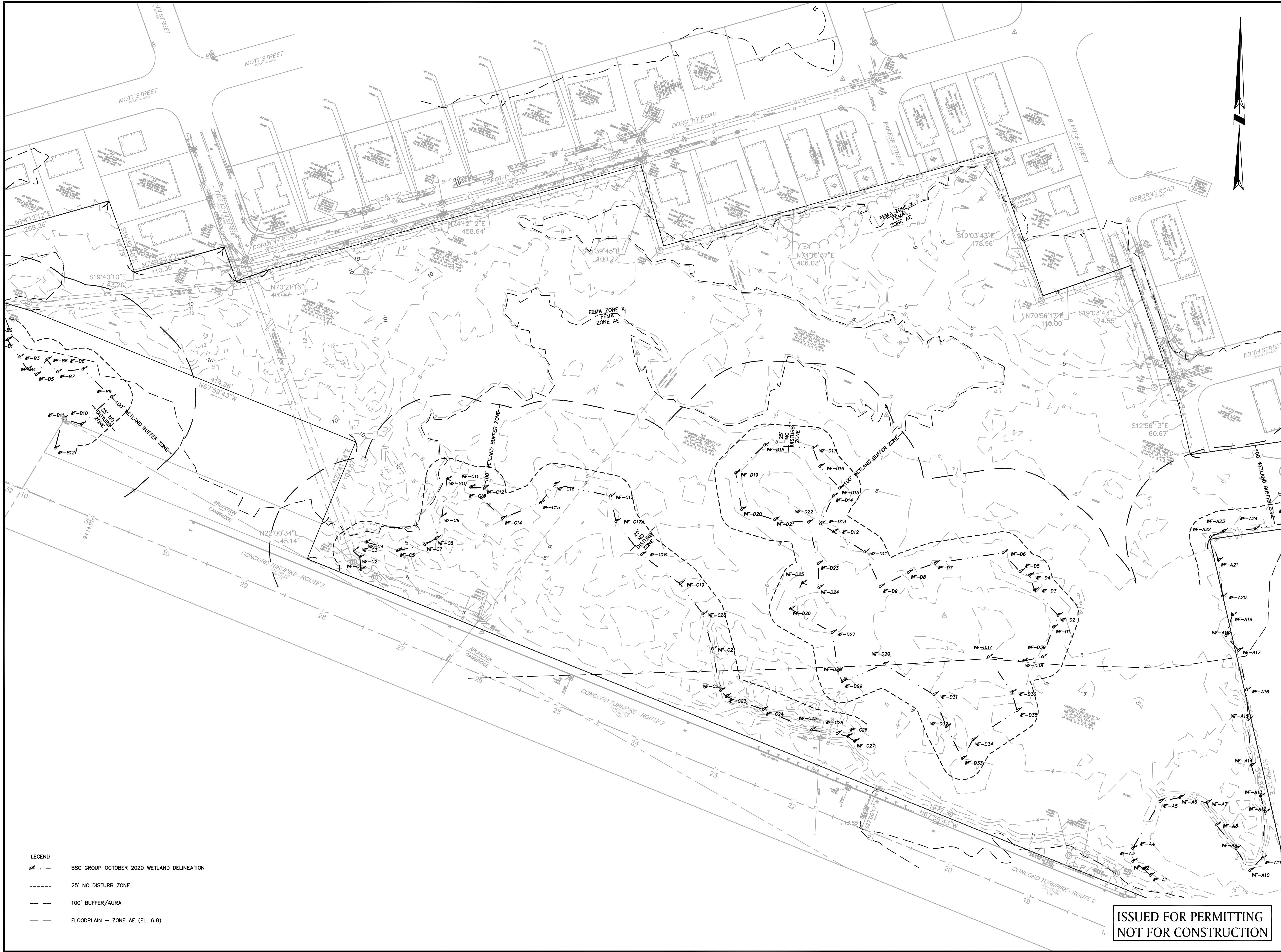
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JOB. NO: 23407.00



# ISSUED FOR PERMITTING NOT FOR CONSTRUCTION



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DATE

THORNDIKE PLACE

DOROTHY ROAD

**ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)**

# EXISTING ENVIRONMENTAL RESOURCES PLAN

MARCH 13, 2020

PREPARED FOR:  
ARLINGTON LAND REALTY, LLC  
84 SHERMAN STREET, 2ND FLOOR  
CAMBRIDGE, MA 02140



803 Summer Street  
Boston, Massachusetts

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**617 806 4300**

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SCALE: 1" = 50'

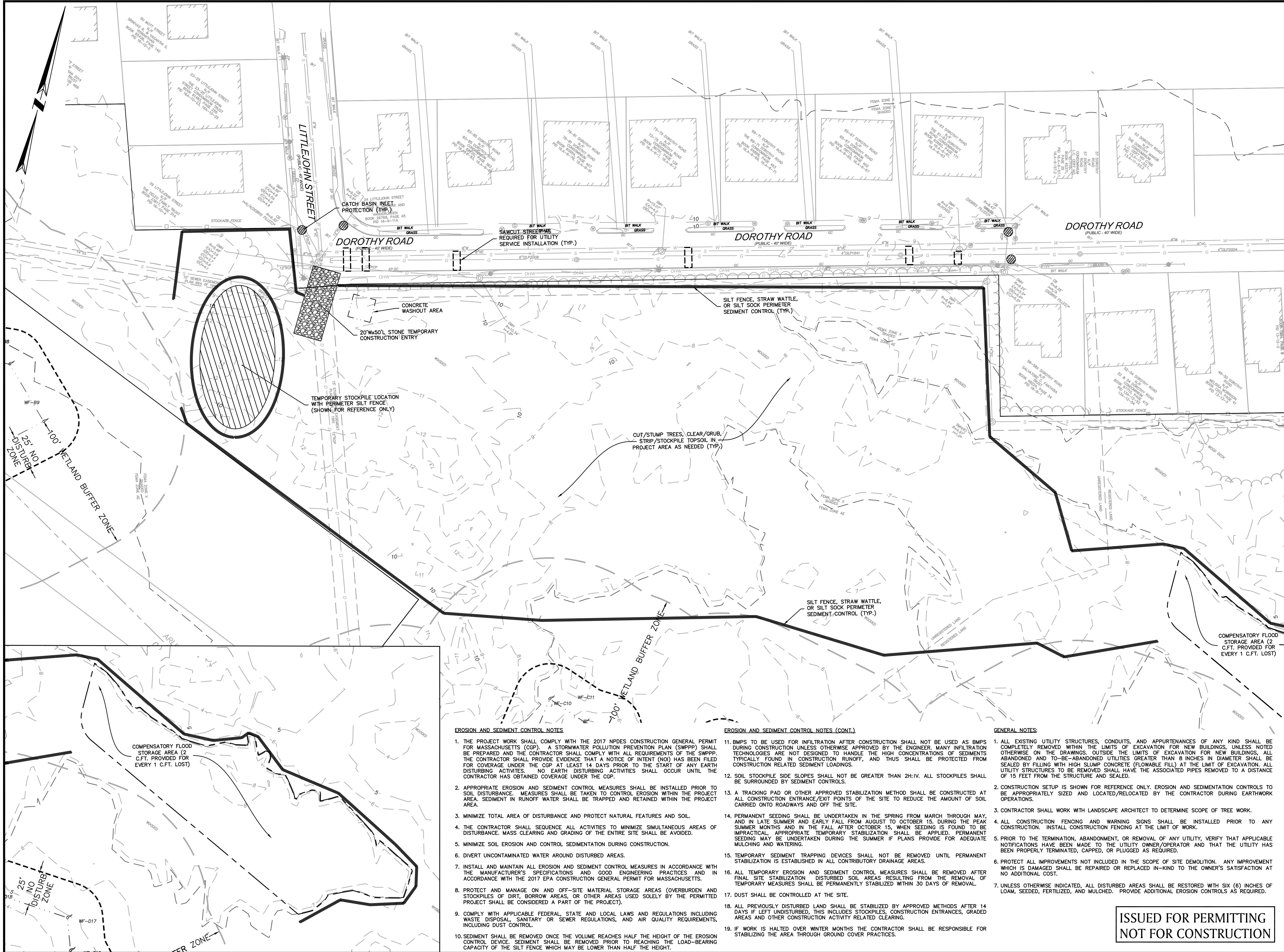
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JOB. NO: 23407.00

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For more information about the study, please contact Dr. John Smith at (555) 123-4567 or email him at [john.smith@researchinstitute.org](mailto:john.smith@researchinstitute.org).



THORNDIKE PLACE

DOROTHY ROAD

IN  
ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

## SITE PREPARATION PLAN

MARCH 13, 2020

PREPARED FOR:  
LINGTON LAND REALTY, LLC  
SHERMAN STREET, 2ND FLOOR  
CAMBRIDGE MA 02140

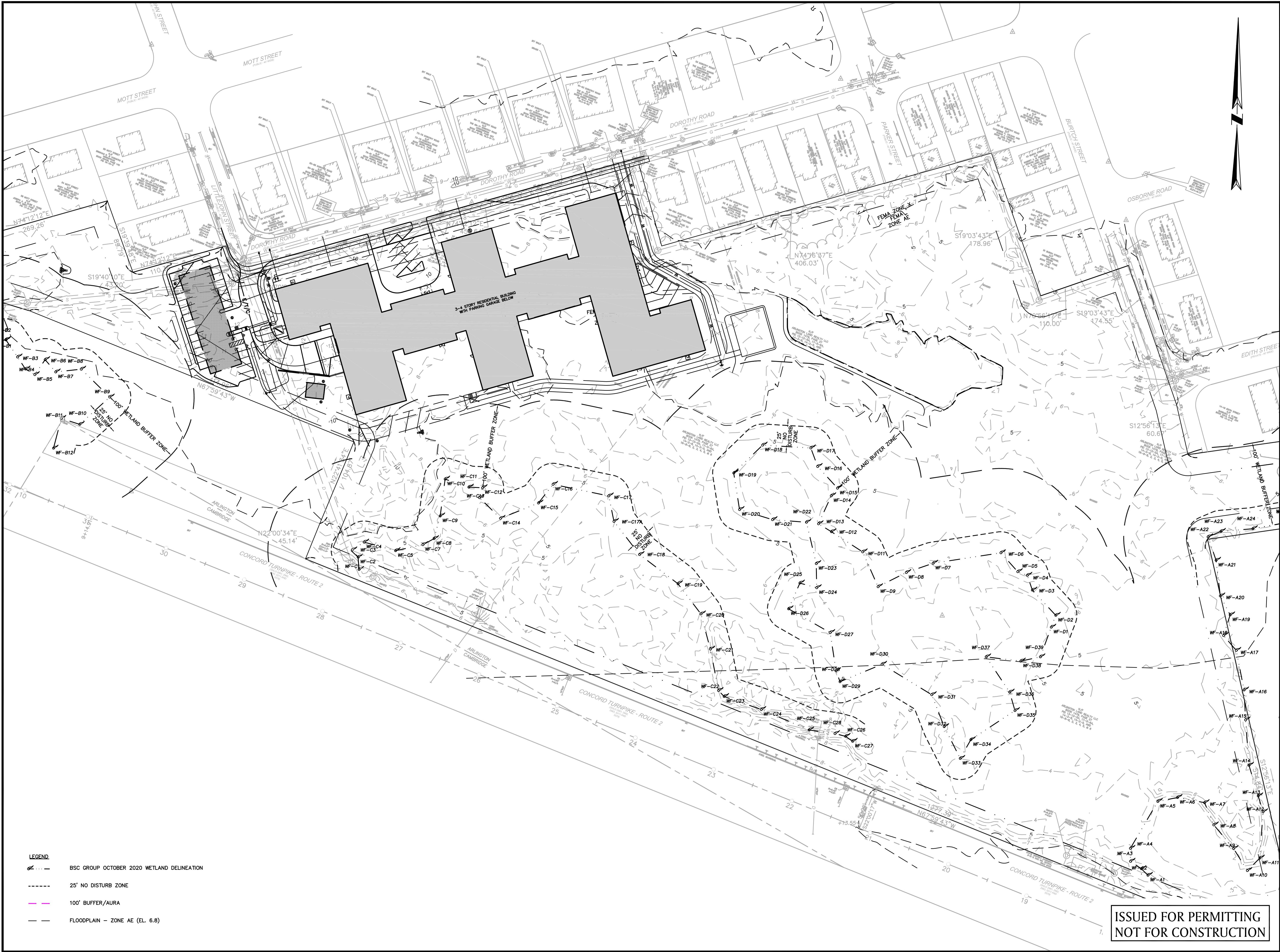
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SCALE: 1" = 30'

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FILE: \Civil\\_\Drawings\2340700-DEM

DWG.:	SHEET C-101
JOB. NO: 23407.00	



JOHN M. HESIEN  
CIVIL  
PROFESSIONAL ENGINEER  
NO. 42747

*[Signature]*

DATE  
PROFESSIONAL ENGINEER

## THORNDIKE PLACE

DOROTHY ROAD

IN  
ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

OVERALL SITE PLAN

MARCH 13, 2020

### REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING

PREPARED FOR:  
ARLINGTON LAND REALTY, LLC  
84 SHERMAN STREET, 2ND FLOOR  
CAMBRIDGE, MA 02140

**BSC GROUP**  
803 Summer Street  
Boston, Massachusetts  
02127

617 896 4300

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SCALE: 1" = 50'  
0 25 50 100 FEET

FILE: 2340700\CD\2340700-SP  
DWG.:  
JOB. NO: 23407.00 SHEET C-102

JOHN M. HESION  
CIVIL  
PROFESSIONAL ENGINEER  
No. 42747

DATE

PROFESSIONAL ENGINEER

## THORNDIKE PLACE

DOROTHY ROAD  
IN  
ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

LAYOUT & MATERIALS  
PLAN

MARCH 13, 2020

REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING

PREPARED FOR:  
ARLINGTON LAND REALTY, LLC  
84 SHERMAN STREET, 2ND FLOOR  
CAMBRIDGE, MA 02140

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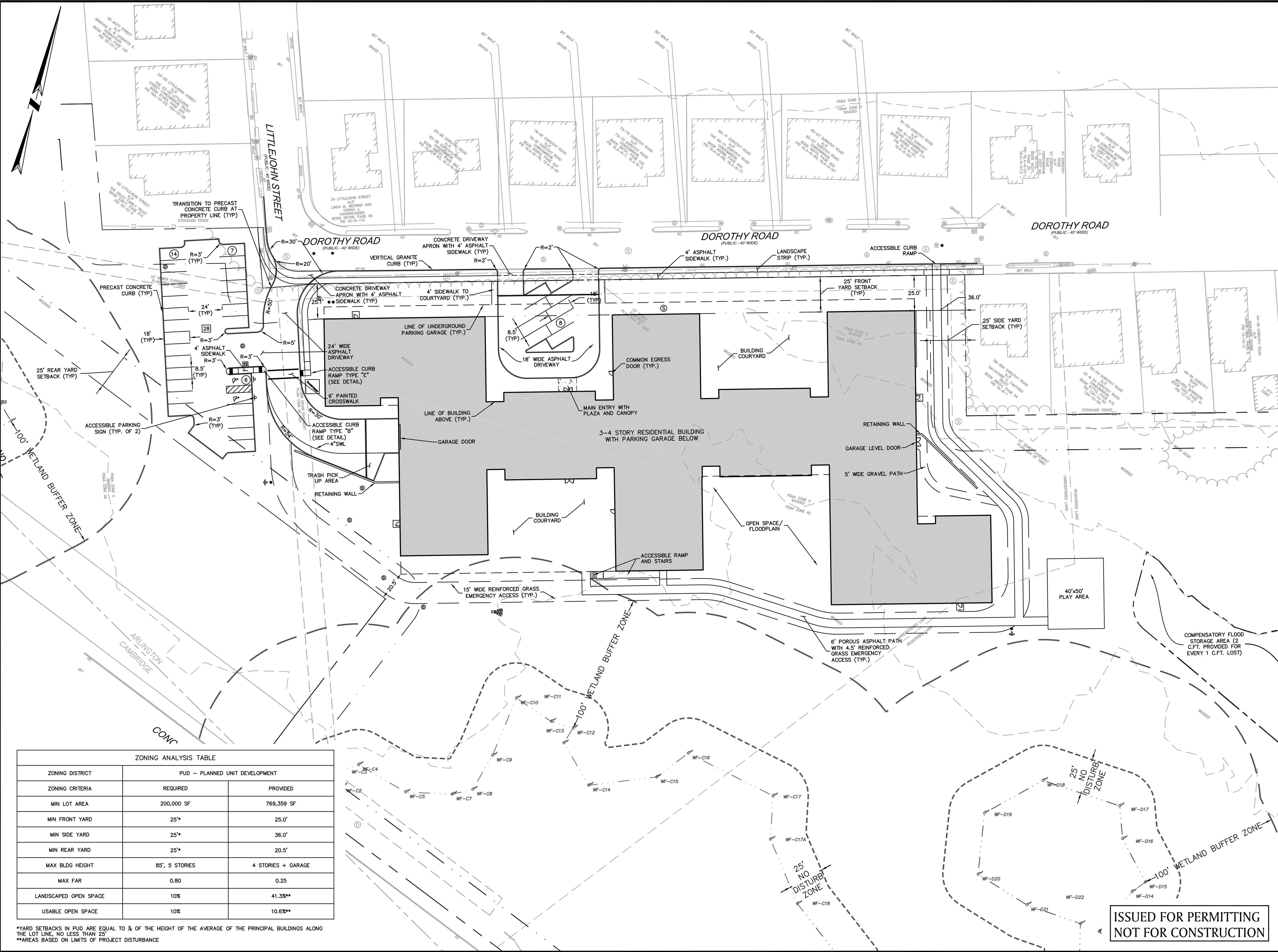
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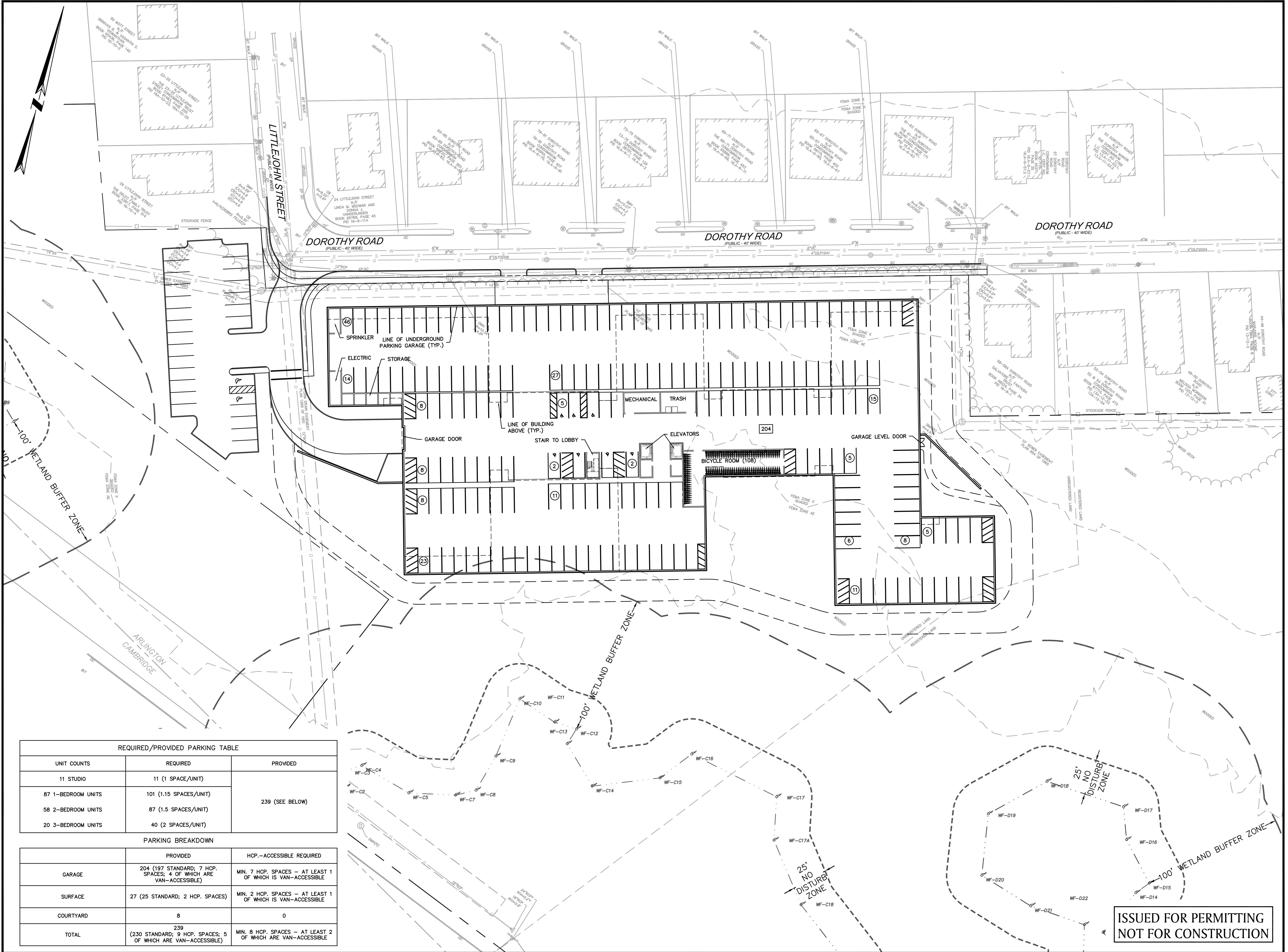
FILE: \Civil\Drawings\2340700-LM

DWG.: SHEET C-103

JOB. NO: 23407.00

ISSUED FOR PERMITTING  
NOT FOR CONSTRUCTION





*John M. Hession*  
JOHN M.  
HESION  
CIVIL  
REGISTERED  
PROFESSIONAL ENGINEER

## THORNDIKE PLACE

DOROTHY ROAD  
IN  
ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

### GARAGE LEVEL PLAN

MARCH 13, 2020

REVISIONS:		
NO.	DATE	DESC.
1	11/03/20	REVISED BUILDING

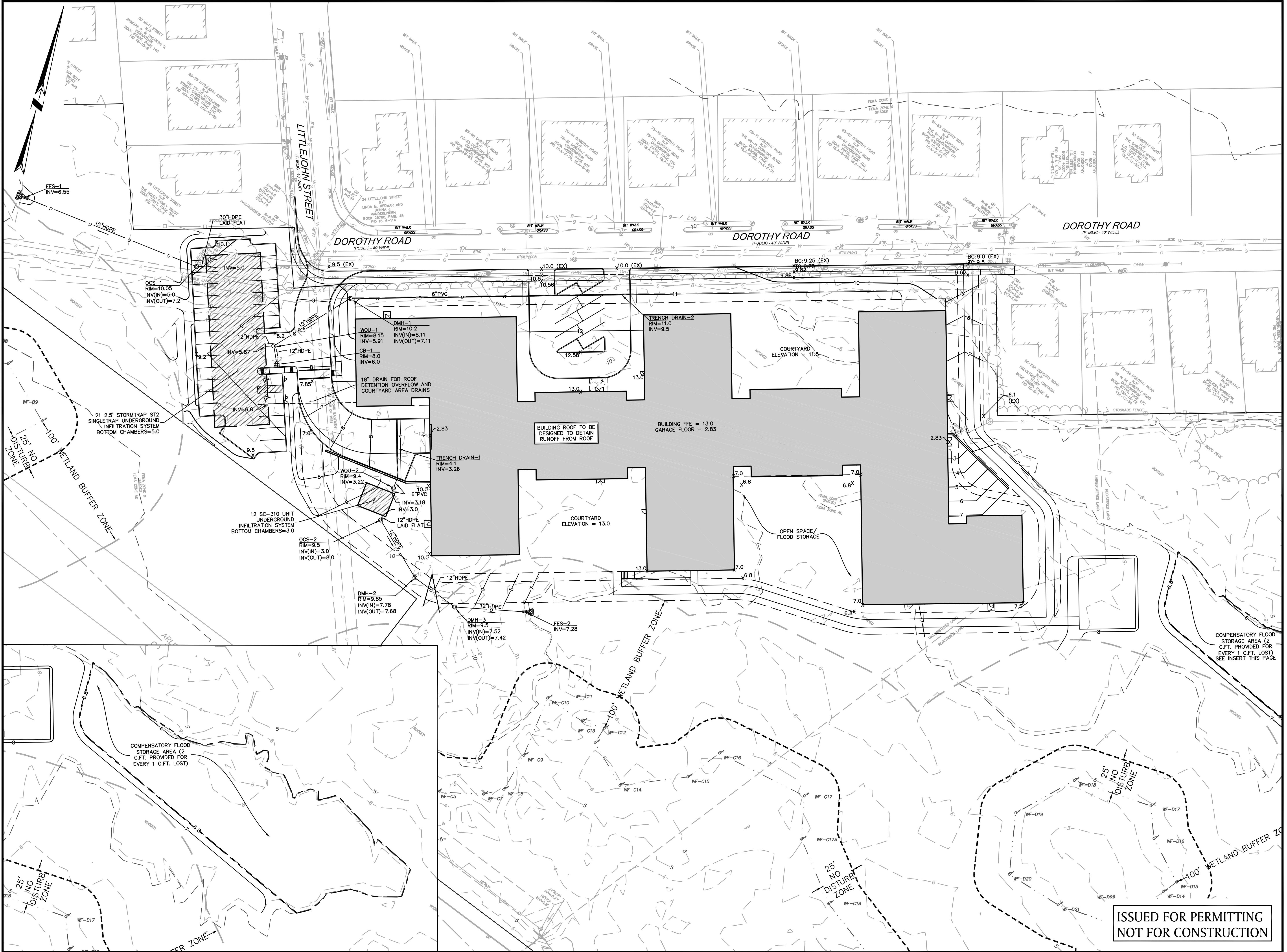
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DWG.: SHEET C-104  
JOB. NO: 23407.00



JOHN M. HESSEN  
CIVIL  
PROFESSIONAL ENGINEER  
*[Signature]*

DATE

## THORNDIKE PLACE

### DOROTHY ROAD

IN  
ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

### GRADING & DRAINAGE PLAN

MARCH 13, 2020

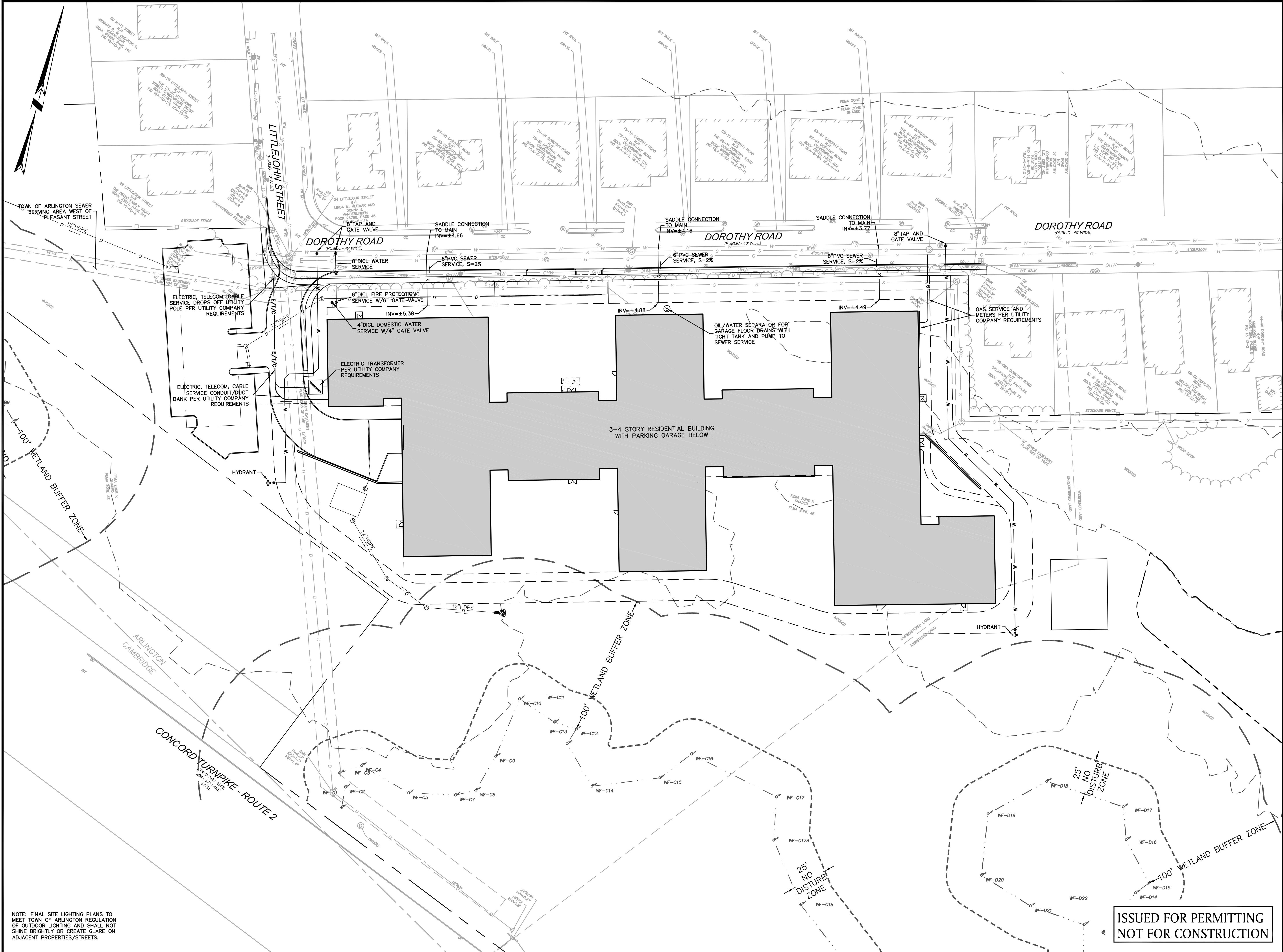
#### REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING

PREPARED FOR:  
ARLINGTON LAND REALTY, LLC  
84 SHERMAN STREET, 2ND FLOOR  
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THORNDIKE PLACE

DOROTHY ROAD  
IN  
ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

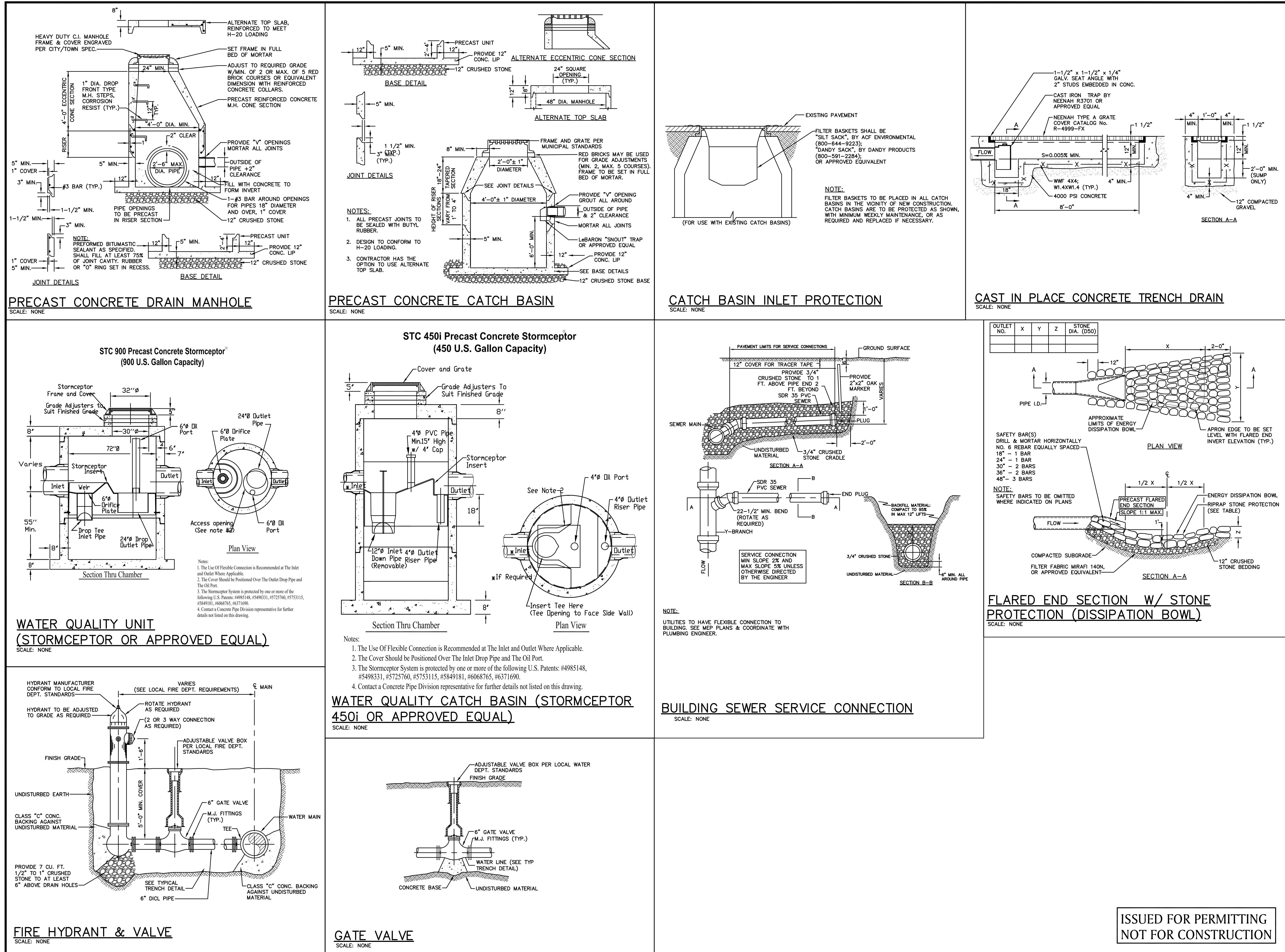
UTILITY PLAN

MARCH 13, 2020











# ***STORMWATER REPORT***

**THORNDIKE PLACE  
DOROTHY ROAD  
ARLINGTON, MA**

NOVEMBER 2020

Owner/Applicant:

**ARLINGTON LAND REALTY LLC**  
84 Sherman Street, 2<sup>nd</sup> Floor  
Cambridge, MA 02140

BSC Job Number: 23407.00

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Prepared by:



803 Summer Street  
Boston, MA 02127

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- APPENDIX B – FEMA MAP
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**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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## **SECTION 1.0**

### **PROJECT INFORMATION**

## 1.01 PROJECT DESCRIPTION

Arlington Realty, LLC (The Applicant) is seeking to construct a new multi-family housing development in Arlington, Massachusetts, hereinafter referred to as “the Project.” The total property area is approximately 17.66 acres and is located off of Dorothy Road near the intersection with Littlejohn Street. The project is bounded on the north by Dorothy Road, on the east by residential properties and Thorndike Field, and bounded on the south and west by Concord Turnpike (Route 2).

The Project consists of clearing and grubbing of the northwest section of the property and construction of one 3-4 story multi-family apartment building with a lower level parking garage, as well as surface parking, walkways, courtyards, a playground, utility services, and a stormwater management system. The building has a footprint of approximately 51,555 square feet.

The Project is designed to comply with the Massachusetts General Laws (M.G.L.) Chapter 40B, which allows developers to override certain aspects of municipal zoning bylaws by providing a certain percentage of affordable housing, as well as the Department of Environmental Protection’s Stormwater Management Standards. There are wetland resource areas in the south, west and east portions of the property. The Project is concentrated in the northwest area of the property and minimizes impacts to the 100-foot wetland buffer zones, which are regulated by the Arlington Wetlands Bylaw as Adjacent Upland Resource Areas (AURA’s). Part of the site is located within the 1% Chance Annual Flood as defined by FEMA which is regulated under the Wetlands Protection Act and the Arlington Wetlands Bylaw as Bordering Land Subject to Flooding (BLSF). Compensatory flood storage is proved at a 2:1 ratio as described in section 2.12 below.

## 1.02 PRE-DEVELOPMENT CONDITIONS

The existing site topography generally slopes southeast across the property towards the wetlands located on the property with slopes ranging from 0-15%. The current site is comprised of forest and the primary soil classification identified by the NRCS Web Soil Survey is udorthents (655), which accounts for the majority of the property and all of the project area. As such, the soils have been modeled as Hydrologic Soil Group C.

The existing site being largely undeveloped has no existing drainage facilities and the majority of the stormwater runoff is directed to the wetlands on the property. A small portion of the site discharges to the north to Dorothy Road.

## 1.03 POST-DEVELOPMENT CONDITIONS

The proposed stormwater management system has been designed in a manner that will exceed the provisions of the Department of Environmental Protection (DEP) Stormwater Management Standards for a new construction project. The design is also in general conformance the with Town of Arlington Zoning Bylaws.

Stormwater runoff from the building will be detained on the roof of the building, with larger, less frequent storms overflowing through roof drains to an underground infiltration system in the adjacent surface parking lot. Stormwater runoff from the small parking/drop-off area at the main entrance to the building will be collected via a trench drain, and runoff from the other surface parking area will be collected in a deep sump catch basin, both of which are conveyed through a water quality unit before being directed to the underground infiltration system. This underground infiltration system will overflow via a flared end section to the northwest. Based upon previous soil investigations on site by others, the estimated seasonal high groundwater elevation is approximately 3.0. As such the infiltration system has been set with a bottom elevation of 5.0 to provide the minimum 2-feet of clearance above groundwater.

Stormwater runoff from the driveway into the garage below the building will be collected via a trench drain and conveyed through a water quality unit before being directed to a second underground infiltration system located directly south of this area. No credit has been taken for recharge from this infiltration system as, due to grades of the driveway, insufficient clearance from estimated seasonal high groundwater exists. This infiltration system will overflow via a flared end section to the area directly south of the proposed building.

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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To provide emergency access to the sides and rear of the building, a reinforced grass access lane will be installed. A portion of this access lane will include a 6-foot wide, porous asphalt walkway to allow residents to have ADA/AAB accessible access the rear of the site including the play area. Both the reinforced grass and porous asphalt will allow stormwater runoff to freely infiltrate back to the ground and will result in negligible runoff.

Specifics of the project's compliance with the Stormwater Standards are discussed in detail in the following sections.

**Stormwater Report**

Thorndike Place

Arlington, MA

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## **SECTION 2.0**

### **DRAINAGE SUMMARY**

## 2.01 Stormwater Standard 1 – New Stormwater Conveyances

Per Massachusetts Stormwater Management Standard #1, no new outfalls may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. No new untreated stormwater discharges are proposed. Rip-rap outlet protection sizing calculations are included in Section 6.0 of this Report.

## 2.02 Stormwater Standard 2 – Stormwater Runoff Rates

Watershed modeling was performed using HydroCAD Stormwater Modeling Software version 10.00, a computer aided design program that combines SCS runoff methodology with standard hydraulic calculations. A model of the site's hydrology was developed for both pre and post-development conditions to assess the effects of the proposed development on the project site and surrounding areas.

The stormwater management system for the project has been designed such that the post-development conditions result in no increase to peak runoff rates to the adjacent wetlands or the adjacent public street for the 2, 10, 25, 50, and 100-year, 24-hour storm events, as detailed in the table below.

Peak Flow Discharge Rates

Node 1S/1L – Flow to Wetlands

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	2.1	1.6	-0.5
10-Year	5.4	4.2	-1.2
25-Year	8.3	6.2	-2.1
50-Year	11.3	8.2	-3.1
100-Year	14.9	12.6	-2.3

Node 2S/2L – Flow to Street

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.2	0.2	0.0
10-Year	0.4	0.4	0.0
25-Year	0.6	0.6	0.0
50-Year	0.8	0.8	0.0
100-Year	1.1	1.0	-0.1

## 2.03 Stormwater Standard 3 – Groundwater Recharge

Groundwater recharge is provided on site via an underground structural infiltration system beneath the surface parking area to the west of the building. Overall, the project will result in no loss of annual recharge to groundwater as required by Standard 3. Refer to Section 6.0 of this Report for groundwater recharge information.

## **2.04 Stormwater Standard 4 – TSS Removal**

As a new development, the Project stormwater management system will achieve a TSS removal greater than 80%. The proposed stormwater management system has been designed to provide treatment of runoff in order to reduce suspended solids prior to discharge off-site through the implementation of the following best management practices:

- Deep Sump Hooded Catch Basins
- Proprietary Hydrodynamic Separator
- Underground Stormwater Infiltration System

The water quality volume is defined as the runoff volume requiring TSS Removal for the site, and is equal to 0.5-inches of runoff over the total impervious area of the post-development site. The required water quality volume for the project is provided in Section 6.0 of this Report

The underground infiltration system has been sized to treat the required water quality volume and calculations are included in Section 6.0 of this Report.

A long-term pollution prevention plan complying with the requirements of Standard 4 is included in Section 4.0 of this Report.

## **2.05 Stormwater Standard 5 – Land Uses with Higher Potential Pollutant Loads**

This standard is not applicable as the project site is not a land use with higher potential pollutant loads (LUHPPL).

## **2.06 Stormwater Standard 6 – Stormwater Discharges to a Critical Area**

This standard is not applicable as runoff from the project site does not discharge to a critical area.

## **2.07 Stormwater Standard 7 – Redevelopment Projects**

This project is a new development and therefore has been designed to fully comply with the Stormwater Management Standards.

## **2.08 Stormwater Standard 8 – Sedimentation and Erosion Control Plan**

Erosion and sedimentation controls are shown on the Project Plans. Additionally, a Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Section 3.0 of this Report.

## **2.09 Stormwater Standard 9 – Long Term Operation and Maintenance Plan**

A Long-Term Operation and Maintenance Plan is included in Section 4.0 of this Report.

## **2.10 Stormwater Standard 10 – Illicit Discharges**

There are no known illicit discharges on the project site and none are proposed.

## **2.11 Conclusion**

The project has been designed in accordance with DEP Stormwater Management Standards and the Town of Arlington Wetlands Protection Bylaw and Regulations. Through the construction of the aforementioned stormwater systems, the project will provide peak rate attenuation, TSS removal and groundwater recharge.

## 2.12 Compensatory Flood Storage

A portion of the project site is located within the 1% Chance Annual Flood as defined by FEMA, which is regulated under the Wetlands Protection Act and Arlington Wetlands Bylaw as Bordering Land Subject to Flooding (BLSF). In order to protect the values provided by BLSF and prevent downstream flooding impacts, the project is required to provide compensatory flood storage on a 1-foot incremental basis to match whatever is lost due to the project's development. Further, Arlington requires compensatory flood storage to be provided at a 2 to 1 ratio for any flood storage lost. In order to provide this compensatory flood storage, the project will minimize the area of BLSF impacted and regrade a portion of the project property southeast of the proposed building as shown on the Plans. A breakdown of the flood storage impacts and compensatory storage provided is shown below:

<u>Elevations</u>	<u>Existing Incremental Available Flood Storage (CU.FT.)</u>	<u>Incremental Available Flood Storage with No Compensatory Storage (CU.FT.)</u>	<u>Incremental Flood Storage Change w/No Compensatory Storage (CU.FT.)</u>	<u>Proposed Incremental Compensatory Storage (CU.FT.)</u>	<u>Ratio of Compensatory Storage to Storage Lost</u>
5.0 - 6.0	67.0	0.0	-67.0	144.5	2.2
6.0 - 6.8	7,454.0	4,806.8	-2,647.2	5,990.0	2.3

As shown above, the project will exceed the 2 to 1 ratio of compensatory flood storage for all flood storage lost due to the project development. In addition, as shown on the Plans, the proposed compensatory storage is hydrologically connected to the flood plain impacted by the project. Therefore, the project as proposed meets the applicable requirements for BLSF in both the Wetlands Protection Act and the Arlington Wetlands Bylaw and Regulations.

## **SECTION 3.0**

### **CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN**

### **3.0 CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN**

This Section specifies requirements and suggestions for implementation of a Stormwater Pollution Prevention Plan (SWPPP) for **Thorndike Place, in Arlington, Massachusetts**. The SWPPP shall be provided and maintained on-site by the Contractor(s) during all construction activities. The SWPPP shall be updated as required to reflect changes to construction activity.

The stormwater pollution prevention measures contained in the SWPPP shall be at least the minimum required by Local Regulations. The Contractor shall provide additional measures to prevent pollution from stormwater discharges in compliance with the National Pollution Discharge Elimination System (NPDES) Phase II permit requirements and all other local, state and federal requirements.

The SWPPP shall include provisions for, but not be limited to, the following:

1. Construction Trailers
2. Lay-down Areas
3. Equipment Storage Areas
4. Stockpile Areas
5. Disturbed Areas

The Contractor shall NOT begin construction without submitting evidence that a NPDES Notice of Intent (NOI) governing the discharge of stormwater from the construction site for the entire construction period has been filed **at least fourteen (14) days prior to construction**. It is the Contractor's responsibility to complete and file the NOI, unless otherwise determined by the project team.

The cost of any fines, construction delays and remedial actions resulting from the Contractor's failure to comply with all provisions of local regulations and Federal NPDES permit requirements shall be paid for by the Contractor at no additional cost to the Owner.

As a requirement of the EPA's NPDES permitting program, each Contractor and Subcontractor responsible for implementing and maintaining stormwater Best Management Practices shall execute a Contractor's Certification form.

#### **Erosion and Sedimentation Control**

The Contractor shall be solely responsible for erosion and sedimentation control at the site. The Contractor shall utilize a system of operations and all necessary erosion and sedimentation control measures, even if not specified herein or elsewhere, to minimize erosion damage at the site to prevent the migration of sediment into environmentally sensitive areas. Environmentally sensitive areas include all wetland resource areas within, and downstream of, the site, and those areas of the site that are not being altered.

Erosion and sedimentation control shall be in accordance with this Section, the design drawings, and the following:

- "National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities (EPA Construction General Permit February 16, 2017).
- Massachusetts Stormwater Management Policy Handbook issued by the Massachusetts Department of Environmental Protection, January 2008.
- Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials, March 1997.

The BMP's presented herein should be used as a guide for erosion and sedimentation control and are not intended to be considered specifications for construction. The most important BMP is maintaining a rapid

construction process, resulting in prompt stabilization of surfaces, thereby reducing erosion potential. Given the primacy of rapid construction, these guidelines have been designed to allow construction to progress with essentially no hindrance by the erosion control methods prescribed. These guidelines have also been designed with sufficient flexibility to allow the Contractor to modify the suggested methods as required to suit seasonal, atmospheric, and site-specific physical constraints.

Another important BMP is the prevention of concentrated water flow. Sheet flow does not have the erosive potential of a concentrated rivulet. These guidelines recommend construction methods that allow localized erosion control and a system of construction, which inhibits the development of shallow concentrated flow. These BMP's shall be maintained throughout the construction process.

## **CONTACT INFORMATION AND RESPONSIBLE PARTIES**

The following is a list of all project-associated parties:

### **Owner**

Arlington Land Realty, LLC  
84 Sherman Street, 2<sup>nd</sup> Floor  
Cambridge, MA 02140

### **Contractor**

To be determined

### **Environmental Consultant**

BSC Group, Inc.  
803 Summer Street  
Boston, MA 02127

Contact: John Hession, P.E.  
Phone: (617) 896-4300  
Email: [jhession@bscgroup.com](mailto:jhession@bscgroup.com)

### **Qualified SWPPP Inspectors**

To Be Determined

### **3.1 Procedural Conditions of the Construction General Permit (CGP)**

The following list outlines the Stormwater Responsibilities for all construction operators working on the Project. The operators below agree through a cooperative agreement to abide by the following conditions throughout the duration of the construction project, effective the date of signature of the required SWPPP. These conditions apply to all operators on the project site.

The project is subject to EPA's NPDES General Permit through the CGP. The goal of this permit is to prevent the discharge of pollutants associated with construction activity from entering the existing and proposed storm drain system or surface waters.

All contractors/operators involved in clearing, grading and excavation construction activities must sign the appropriate certification statement required, which will remain with the SWPPP. The owner must also sign a certification, which is to remain with the SWPPP in accordance with the signatory requirements of the SWPPP.

Once the SWPPP is finalized, a signed copy, plus supporting documents, must be held at the project site during construction. A copy must remain available to EPA, State and Local agencies, and other interested parties during normal business hours.

The following items associated with this SWPPP must be posted in a prominent place at the construction site until final stabilization has been achieved:

- The completed/submitted NOI form
- Location where the public can view the SWPPP during normal business hours
- A copy of the signed/submitted NOI, permit number issued by the EPA and a copy of the current CGP.

Project specific SWPPP documents are not submitted to the US EPA unless the agency specifically requests a copy for review. SWPPP documents requested by a permitting authority, the permittee(s) will submit it in a timely manner.

EPA inspectors will be allowed free and unrestricted access to the project site and all related documentation and records kept under the conditions of the permit.

The permittee is expected to keep all BMP's and Stormwater controls operating correctly and maintained regularly.

Any additions to the project which will significantly change the anticipated discharges of pollutants, must be reported to the EPA. The EPA should also be notified in advance of any anticipated events of noncompliance. The permittee must also orally inform the EPA of any discharge, which may endanger health or the environment within 24 hours, with a written report following within 5 days.

In maintaining the SWPPP, all records and supporting documents will be compiled together in an orderly fashion. Inspection reports and amendments to the SWPPP must remain with the document. Federal regulations require permittee(s) to keep their Project Specific SWPPP and all reports and documents for at least three (3) years after the project is complete.

### **3.2 Existing Site and Soil Conditions**

The total project area is approximately 17.66 acres and is located off of Dorothy Road. The project is bounded on the north by Dorothy Road, bounded on the east by residential properties, and bounded on the south and west by Concord Turnpike (Route 2).

The current site is comprised of forest and the primary soil classification identified by the NRCS Web Soil Survey is udorthents (655), which accounts for the majority of the property and all of the project area. As such, the soils have been modeled as Hydrologic Soil Group C.

### **3.3 Project Description and Intended Construction Sequence**

The site is currently comprised of woods. The proposed activities will include the following major components:

- The construction of one (1) multi-family housing building with associated parking, driveways, and walkways,
- The construction of stormwater management systems, and
- Site grading, and utility installation.

The proposed project will disturb a total of approximately 138,233± S.F. (3.17± acres).

Soil disturbing activities will include site demolition, installing stabilized construction exits, installation of erosion and sedimentation controls, grading, storm drain inlets, stormwater management systems, utilities,

building foundation, construction of site driveways and preparation for final landscaping. Please refer to Table 1 for the projects anticipated construction timetable. A description of BMP's associated with project timetable and construction-phasing elements is provided in this Erosion and Sediment Control Plan.

**Table 1 – Anticipated Construction Timetable**

Construction Phasing Activity	Anticipated Timetable
Grubbing and Stripping of Limits of Construction Phase	To be determined
Rough Site Grading and Site Utilities	To be determined
Utility Plan Construction	To be determined
Landscaping	To be determined

### **3.4 Potential Sources of Pollution**

Any project site activities that have the potential to add pollutants to runoff are subject to the requirements of the SWPPP. Listed below are a description of potential sources of pollution from both sedimentation to Stormwater runoff, and pollutants from sources other than sedimentation.

**Table 2 – Potential Sources of Sediment to Stormwater Runoff**

Potential Source	Activities/Comments
Construction Site Entrance and Site Vehicles	Vehicles leaving the site can track soils onto public roadways. Site Vehicles can readily transport exposed soils throughout the site and off-site areas.
Grading Operations	Exposed soils have the potential for erosion and discharge of sediment to off-site areas.
Material Excavation, Relocation, and Stockpiling	Stockpiling of materials during excavation and relocation of soils can contribute to erosion and sedimentation. In addition, fugitive dust from stockpiled material, vehicle transport and site grading can be deposited in wetlands and waterway.
Landscaping Operations	Landscaping operations specifically associated with exposed soils can contribute to erosion and sedimentation. Hydroseeding, if not properly applied, can runoff to adjacent wetlands and waterways.

**Table 3 – Potential Pollutants and Sources, other than Sediment to Stormwater Runoff**

Potential Source	Activities/Comments
Staging Areas and Construction Vehicles	Vehicle refueling, minor equipment maintenance, sanitary facilities and hazardous waste storage
Materials Storage Area	General building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
Construction Activities	Construction, paving, curb/gutter installation, concrete pouring/mortar/stucco

### **3.5 Erosion and Sedimentation Control Best Management Practices**

All construction activities will implement Best Management Practices (BMP's) in order to minimize overall site disturbance and impacts to the sites natural features. Please refer to the following sections for a detailed description of site specific BMP's. In addition, an Erosion and Sedimentation Control Plan is provided in the Site Plans.

### **3.6 Timetable and Construction Phasing**

This section provides the Owner and Contractor with a suggested order of construction that shall minimize erosion and the transport of sediments. The individual objectives of the construction techniques described herein shall be considered an integral component of the project design intent of each project phase. The construction sequence is not intended to prescribe definitive construction methods and should not be interpreted as a construction specification document. However, the Contractor shall follow the general construction phase principles provided below:

- Protect and maintain existing vegetation wherever possible.
- Minimize the area of disturbance.
- To the extent possible, route unpolluted flows around disturbed areas.
- Install mitigation devices as early as possible.
- Minimize the time disturbed areas are left unstabilized.
- Maintain siltation control devices in proper condition.
- The contractor should use the suggested sequence and techniques as a general guide and modify the suggested methods and procedures as required to best suit seasonal, atmospheric, and site specific physical constraints for the purpose of minimizing the environmental impact of construction.

#### **Demolition, Grubbing and Stripping of Limits of Construction Phase**

- Install Temporary Erosion Control (TEC) devices as required to prevent sediment transport into resource areas.
- Place a ring of silt socks and/or haybales around stockpiles.
- Stabilize all exposed surfaces that will not be under immediate construction.
- Store and/or dispose all pavement and building demolition debris as indicated in accordance with all applicable local, state, and federal regulations.

#### **Driveway Area Sub-Base Construction**

- Install temporary culverts and diversion ditches and additional TEC devices as required by individual construction area constraints to direct potential runoff toward detention areas designated for the current construction phase.
- Compact gravel as work progresses to control erosion potential.
- Apply water to control air suspension of dust.
- Avoid creating an erosive condition due to over-watering.
- Install piped utility systems as required as work progresses, keeping all inlets sealed until all downstream drainage system components are functional.

#### **Binder Construction**

- Fine grade gravel base and install processed gravel to the design grades.
- Compact pavement base as work progresses.
- Install pavement binder coat starting from the downhill end of the site and work toward the top.

#### **Finish Paving**

- Repair and stabilize damaged side slopes.
- Clean inverts of drainage structures.
- Install final top coat of pavement.

### Final Clean-up

- Clean inverts of culverts and catch basins.
- Remove sediment and debris from rip-rap outlet areas.
- Remove TEC devices only after permanent vegetation and erosion control has been fully established.

## **3.7 Site Stabilization**

### Grubbing Stripping and Grading

- Erosion control devices shall be in place as shown on the design plans before grading commences.
- Stripping shall be done in a manner, which will not concentrate runoff. If precipitation is expected, earthen berms shall be constructed around the area being stripped, with a silt sock, silt fence or haybale dike situated in an arc at the low point of the berm.
- If intense precipitation is anticipated, silt socks, haybales, dikes and /or silt fences shall be used as required to prevent erosion and sediment transport. The materials required shall be stored on site at all time.
- If water is required for soil compaction, it shall be added in a uniform manner that does not allow excess water to flow off the area being compacted.
- Dust shall be held at a minimum by sprinkling exposed soil with an appropriate amount of water.

### Maintenance of Disturbed Surfaces

- Runoff shall be diverted from disturbed side slopes in both cut and fill.
- Mulching may be used for temporary stabilization.
- Silt sock, haybale or silt fences shall be set where required to trap products of erosion and shall be maintained on a continuing basis during the construction process.

### Loaming and Seeding

- Loam shall not be placed unless it is to be seeded directly thereafter.
- All disturbed areas shall have a minimum of 4" of loam placed before seeded and mulched.
- Consideration shall be given to hydro-mulching, especially on slopes in excess of 3 to 1.
- Loamed and seeded slopes shall be protected from washout by mulching or other acceptable slope protection until vegetation begins to grow.

### Stormwater Collection System Installation

- The Stormwater drainage system shall be installed from the downstream end up and in a manner which will not allow runoff from disturbed areas to enter pipes.
- Excavation for the drainage system shall not be left open when rainfall is expected overnight. If left open under other circumstances, pipe ends shall be closed by a staked board or by an equivalent method.
- All catch basin openings shall be covered by a silt bag between the grate and the frame or protected from sediment by silt fence surrounding the catch basin grate.

### Completion of Paved Areas

- During the placement of sub-base and pavement, the entrance to the Stormwater drainage systems shall be sealed when rain is expected. When these entrances are closed, consideration must be given to the direction of run-off and measures shall be undertaken to minimize erosion and to provide for the collection of sediment.
- In some situations it may be necessary to keep catch basins open.

- Appropriate arrangements shall be made downstream to remove all sediment deposition.

#### Stabilization of Surfaces

- Stabilization of surfaces includes the placement of pavement, rip-rap, wood bark mulch and the establishment of vegetated surfaces.
- Upon completion of construction, all surfaces shall be stabilized even though it is apparent that future construction efforts will cause their disturbance.
- Vegetated cover shall be established during the proper growing season and shall be enhanced by soil adjustment for proper pH, nutrients and moisture content.
- Surfaces that are disturbed by erosion processes or vandalism shall be stabilized as soon as possible.
- Areas where construction activities have permanently or temporarily ceased shall be stabilized within 14 days from the last construction activity, except when construction activity will resume within 21 days (e.g., the total time period that construction activity is temporarily ceased is less than 21 days).
- Hydro-mulching of grass surfaces is recommended, especially if seeding of the surfaces is required outside the normal growing season.
- Hay mulch is an effective method of temporarily stabilizing surfaces, but only if it is properly secured by branches, weighted snow fences or weighted chicken wire.

### **3.8 Temporary Structural Erosion Control Measures**

Temporary erosion control measures serve to minimize construction-associated impacts to wetland resource and undisturbed areas. Please refer to the following sections for a description of temporary erosion control measures implemented as part of the project and this sample SWPPP.

#### **3.8.1 Silt Socks, Haybales, and Silt Fencing**

The siltation barriers will demarcate the limit of work, form a work envelope and provide additional assurance that construction equipment will not enter the adjacent wetlands or undisturbed portions of the site. All barriers will remain in place until disturbed areas are stabilized.

#### **3.8.2 Temporary Stormwater Diversion Swale**

A temporary diversion swale is an effective practice for temporarily diverting stormwater flows and to reduce stormwater runoff velocities during storm events. The swale channel can be installed before infrastructure construction begins at the site, or as needed throughout the construction process. The diversion swale should be routinely compacted or seeded to minimize the amount of exposed soil.

#### **3.8.3 Dewatering Basins**

Dewatering may be required during stormwater system, foundation construction and utility installation. Should the need for dewatering arise, groundwater will be pumped directly into a temporary settling basin, which will act as a sediment trap during construction. All temporary settling basins will be located within close proximity of daily work activities. Prior to discharge, all groundwater will be treated by means of the settling basin or acceptable substitute. Discharges from sediment basins will be free of visible floating, suspended and settleable solids that would impair the functions of a wetland or degrade the chemical composition of the wetland resource area receiving ground or surface water flows and will be to the combined system.

#### **3.8.4 Material Stockpiling Locations**

Piping and trench excavate associated with the subsurface utility work will be contained with a single row of silt socks and/or haybales.

### **3.9 Permanent Structural Erosion Control Measures**

Permanent erosion control measures serve to minimize post-construction impacts to wetland resource areas and undisturbed areas. Please refer to the Site Plans and Long-Term Operations and Maintenance Plan for a description of permanent erosion control measures implemented as part of the project and this SWPPP.

### **3.10 Good Housekeeping Best Management Practices**

#### **3.10.1 Material Handling and Waste Management**

Solid waste generation during the construction period will be primarily construction debris. The debris will include scrap lumber (used forming and shoring pallets and other shipping containers), waste packaging materials (plastic sheeting and cardboard), scrap cable and wire, roll-off containers (or dumpsters) and will be removed by a contract hauler to a properly licensed landfill. The roll-off containers will be covered with a properly secured tarp before the hauler exits the site. In addition to construction debris, the construction work force will generate some amount of household-type wastes (food packing, soft drink containers, and other paper). Trash containers for these wastes will be located around the site and will be emptied regularly so as to prevent wind-blown litter. This waste will also be removed by a contract hauler.

All hazardous waste material such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers in the hazardous-materials storage area and segregated from other non-waste materials. Secondary containment will be provided for all materials in the hazardous materials storage area and will consist of commercially available spill pallets. Additionally, all hazardous materials will be disposed of in accordance with federal, state and municipal regulations.

Two temporary sanitary facilities (portable toilets) will be provided at the site in the combined staging area. The toilets will be away from a concentrated flow path and traffic flow and will have collection pans underneath as secondary treatment. All sanitary waste will be collected from an approved party at a minimum of three times per week.

#### **3.10.2 Building Material Staging Areas**

Construction equipment and maintenance materials will be stored at the combined staging area and materials storage areas. Silt fence will be installed around the perimeter to designate the staging and materials storage area. A watertight shipping container will be used to store hand tools, small parts and other construction materials.

Non-hazardous building materials such as packaging material (wood, plastic and glass) and construction scrap material (brick, wood, steel, metal scraps, and pine cuttings) will be stored in a separate covered storage facility adjacent to other stored materials. All hazardous-waste materials such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed containers under cover within the hazardous materials storage area.

Large items such as framing materials and stockpiled lumber will be stored in the open storage area. Such materials will be elevated on wood blocks to minimize contact with runoff.

The combined storage areas are expected to remain clean, well-organized and equipped with ample cleaning supplies as appropriate for the materials being stored. Perimeter controls such as containment structures, covers and liners will be repaired or replaced as necessary to maintain proper function.

#### **3.10.3 Designated Washout Areas**

Designated temporary, below-ground concrete washout areas will be constructed, as required, to minimize the pollution potential associated with concrete, paint, stucco, mixers etc. Signs will, if required, be posted marking the location of the washout area to ensure that concrete equipment operators use the proper facility.

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Concrete pours will not be conducted during or before an anticipated precipitation event. All excess concrete and concrete washout slurries from the concrete mixer trucks and chutes will be discharged to the washout area or hauled off-site for disposal.

### **3.10.4 Equipment/Vehicle Maintenance and Fueling Areas**

Several types of vehicles and equipment will be used on-site throughout the project including graders, scrapers, excavators, loaders, paving equipment, rollers, trucks and trailers, backhoes and forklifts. All major equipment/vehicle fueling and maintenance will be performed off-site. A small, 20-gallon pickup bed fuel tank will be kept on-site in the combined staging area. When vehicle fueling must occur on-site, the fueling activity will occur in the staging area. Only minor equipment maintenance will occur on-site. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets. Absorbent, spill-cleanup materials and spill kits will be available at the combined staging and materials storage area. Drip pans will be placed under all equipment receiving maintenance and vehicles and equipment parked overnight.

### **3.10.5 Equipment/Vehicle Wash down Area**

All equipment and vehicle washing will be performed off-site.

### **3.10.6 Spill Prevention Plan**

A spill containment kit will be kept on-site in the Contractor's trailer and/or the designated staging area throughout the duration of construction. Should there be an accidental release of petroleum product into a resource area, the appropriate agencies will be immediately notified.

### **3.10.7 Inspections**

Maintenance of existing and proposed BMP's to address stormwater management facilities during construction is an on-going process. The purpose of the inspections is to observe all sources of stormwater or non-stormwater discharge as identified in the SWPPP as well as the status of the receiving waters and fulfill the requirements of the Order of Conditions. The following sections describe the appropriate inspection measures to adequately implement the project's SWPPP. A blank inspection form is provided at the end of this section. Completed inspection forms are to be maintained on site.

#### Inspection Personnel

The owner's appointed representative will be responsible for performing regular inspections of erosion controls and ordering repairs as necessary.

#### Inspection Frequency

Inspections will be performed by qualified personnel once every 7 days and within 24-hours after a storm event of greater than one-quarter inch, in accordance with the CGP. The inspections must be documented on the inspection form provided at the end of this section, and completed forms will be provided to the on-site supervisor and maintained at the Owner's office throughout the entire duration of construction.

#### Inspection Reporting

Each inspection report will summarize the scope of the inspection, name(s) and qualifications of personnel making the inspection, and major observations relating to the implementation of the SWPPP, including compliance and non-compliance items. Completed inspection reports will remain with the completed SWPPP on site.

### **3.10.8 Amendment Requirements**

The final SWPPP is intended to be a working document that is utilized regularly on the construction site, and provides guidance to the Contractor. It must reflect changes made to the originally proposed plan and will be updated to include project specific activities and ensure that they are in compliance with the NPDES General Permit and state and local laws and regulations. It should be amended whenever there is a change in design, construction, operation or maintenance that affects discharge of pollutants. The following items should be addressed should an amendment to the SWPPP occur:

- Dates of certain construction activities such as major grading activities, clearing and initiation of and completion of stabilization measures should be recorded.
- Future amendments to the SWPPP will be recorded as required. As this SWPPP is amended, all amendments will be kept on site and made part of the SWPPP.
- Upon completion of site stabilization (completed as designed and/or 70% background vegetative cover), it can be documented and marked on the plans. Inspections are no longer required at this time.
- Inspections often identify areas not included in the original SWPPP, which will require the SWPPP to be amended. These updates should be made within seven days of being recognized by the inspector.

### **3.11 SWPPP Inspection and Maintenance Report**

The following form is an example to be used for SWPPP Inspection Reporting.

# Stormwater Construction Site Inspection and Maintenance Report

TO BE COMPLETED AT LEAST EVERY 7 DAYS AND WITHIN 24 HOURS OF A STORM EVENT OF AT LEAST 0.25 INCHES. AFTER SITE STABILIZATION, TO BE COMPLETED AT LEAST ONCE PER MONTH FOR THREE YEARS OR UNTIL A NOTICE OF TERMINATION IS FILED (IF APPLICABLE).

General Information			
<b>Project Name</b>	Thorndike Place		
<b>NPDES Tracking No. (if applicable)</b>		<b>Location</b>	Dorothy Road Arlington, MA
<b>Date of Inspection</b>		<b>Start/End Time</b>	
<b>Inspector's Name(s)</b>			
<b>Inspector's Title(s)</b>			
<b>Inspector's Contact Information</b>			
<b>Inspector's Qualifications</b>			
<b>Describe present phase of construction</b>			
<b>Type of Inspection:</b> <input type="checkbox"/> Regular <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event			
Weather Information			
<b>Has there been a storm event since the last inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No			
<b>If yes, provide:</b> Storm Start Date & Time:                              Storm Duration (hrs):                              Approximate Amount of Precipitation (in):			
<b>Weather at time of this inspection?</b> <input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snowing <input type="checkbox"/> High Winds <input type="checkbox"/> Other:                                      Temperature:			
<b>Have any discharges occurred since the last inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>If yes, describe:</b>			
<b>Are there any discharges at the time of inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>If yes, describe:</b>			

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**Site-specific BMPs**

- Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.
- Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	<b>BMP</b>	<b>BMP Installed?</b>	<b>BMP Maintenance Required?</b>	<b>Corrective Action Needed and Notes Action required by whom and when</b>
1	Catch Basin Protection	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Haybale & Silt Fencing	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Straw Wattles	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Construction Entrance	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Sediment Basins	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	Dewatering Pit	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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**Overall Site Issues**

*Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.*

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Are discharge points and receiving waters free of any sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Are storm drain inlets properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	Is the construction exit preventing sediment from being tracked into the street?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Vehicle Maintenance not allowed on site
10	Are materials that are potential stormwater	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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	<b>BMP/activity</b>	<b>Implemented?</b>	<b>Maintenance Required?</b>	<b>Corrective Action Needed and Notes Action required by whom and when</b>
	contaminants stored inside or under cover?			
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12	(Other)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

**Non-Compliance**

Describe any incidents of non-compliance not described above:

**CERTIFICATION STATEMENT**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

**Print name and title:** \_\_\_\_\_  
(Qualified Person Performing the Inspection)

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Print name and title:** \_\_\_\_\_  
(Contractor/Operator)

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Stormwater Report**

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## **SECTION 4.0**

### **LONG-TERM POLLUTION PREVENTION & OPERATION AND MAINTENANCE PLAN**

## **4.0 LONG-TERM POLLUTION PREVENTION & OPERATION AND MAINTENANCE PLAN**

As required by Standard #4 of the Stormwater Management Policy, this Long-Term Pollution Prevention Plan has been developed for source control and pollution prevention at the site after construction.

### **MAINTENANCE RESPONSIBILITY**

Ensuring that the provisions of the Long-Term Pollution Prevention Plan are followed will be the responsibility of The Applicant, Arlington Land Realty, LLC.

### **GOOD HOUSEKEEPING PRACTICES**

The site to be kept clean of trash and debris at all times. Trash, junk, etc. is not to be left outside.

### **VEHICLE WASHING CONTROLS**

The following BMP's, or equivalent measures, methods or practices are required if you are engaged in vehicle washing and/or steam cleaning:

It is allowable to rinse down the body or a vehicle, including the bed of a truck, with just water without doing any wash water control BMP's.

If you wash (with mild detergents) on an area that infiltrates water, such as gravel, grass, or loose soil, it is acceptable to let the wash water infiltrate as long as you only wash the body of vehicles.

However, if you wash on a paved area and use detergents or other cleansers, or if you wash/rinse the engine compartment or the underside of vehicles, you must take the vehicles to a commercial vehicle wash.

### **REQUIREMENTS FOR ROUTINE INSPECTIONS AND MAINTENANCE OF STORMWATER BMPs**

All stormwater BMPs are to be inspected and maintain as follows;

#### ***Haybales, Silt Fence, and other temporary measures***

The temporary erosion control measures will be installed up gradient of any wetland resource area where any disturbance or alteration might otherwise allow for erosion or sedimentation. They will be regularly inspected to ensure that they are functioning adequately. Additional supplies of these temporary measures will be stockpiled on site for any immediate needs or routine replacement.

#### ***Deep Sump Hooded Catch Basins***

Regular maintenance is essential. Catch basins remain effective at removing pollutants only if they are cleaned out frequently. Inspect or clean basins at least four times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or whenever the depth of the deposits in the catch basin sump is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

#### ***Water Quality Treatment Units***

The water quality treatment structures require periodic inspection and cleaning to maintain operation and function. Owners should have these units inspected on a semi-annual basis and after periods of intense precipitation. Inspections can be done by using a clear Plexiglas tube ("sludge judge") to extract a water column sample. When sediment accumulation reaches 15% of storage capacity, cleaning of the unit is required.

These water quality structures must and will be checked and cleaned immediately after petroleum spills; contact appropriate regulatory agencies.

Maintenance of these units should be done by a vacuum truck that will remove the water, sediment, debris, floating hydrocarbons and other materials in unit. Proper cleaning and disposal of the removed materials and liquid must be followed.

### ***Underground Infiltration System***

Maintenance is required for the proper operation of the underground infiltration system. Infiltration systems are prone to failure due to clogging if the upstream water quality units are not maintained. The use of pretreatment BMPs will minimize failure and maintenance requirements.

After construction, the infiltration system shall be inspected after every major storm for the first few months to ensure proper stabilization and function. Water levels in the access ports shall be recorded over several days to check the drainage of the systems. It is recommended that a log book be maintained showing the depth of water in the detention/infiltration systems at each observation in order to determine the rate at which the system dewatered after runoff producing storm events. Once the performance characteristics of the detention/infiltration have been verified, the monitoring schedule can be reduced to an annual basis, unless the performance data suggests that a more frequent schedule is required.

Preventive maintenance on the infiltration system shall be performed at least twice a year, and sediment shall be removed from any and all pretreatment and collection structures. Sediment shall be removed when deposits approach within six inches of the invert heights of connecting pipes between unit rows, or in sumped inlet structures. Ponded water inside the systems (as visible from the access ports) that remains after several days most likely indicates that the bottom of the system is clogged and will require cleaning or replacement.

The system is designed with a defined top portal area at the “down-flow” end of the chamber that can be cut out to accept up to a 10-inch diameter riser pipe. The 10-inch riser can be used as an observation well and as access for a vacuum truck tube for use in removing sediment. The “down flow” ends of the units have end walls that are closed on the bottom. The closed bottom functions like a coffer dam, with most of the sediment depositing prior to flowing into the next chamber, facilitating its removal through the riser pipe, which is positioned directly above this area.

### ***Pipe Outlet Protection***

The outlet protection should be checked at least annually and after every major storm. If the rip-rap has been displaced, undermined or damaged, it should be repaired immediately. The channel immediately below the outlet should be checked to see that erosion is not occurring. The downstream channel should be kept clear of obstructions such as fallen trees, debris, and sediment that could change flow patterns and/or tailwater depths on the pipes. Repairs must be carried out immediately to avoid additional damage to the outlet protection apron.

## **PROVISIONS FOR MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPE AREAS**

### *Suggested Maintenance Operations*

#### **A. Trees and Shrubs**

**Disease and Pest Management** - Prevention of disease or infestation is the first step of Pest Management. A plant that is in overall good health is far less susceptible to disease. Good general landscape maintenance can reduce problems from disease.

Inspections of plant materials for signs of disease or infestation are to be performed monthly by the Landscape Maintenance Contractor's Certified Arborist. This is a critical step for early diagnosis. Trees and Shrubs that have been diagnosed to have a plant disease or an infestation of insect pests are to be treated promptly with an appropriate material by a licensed applicator.

**Fertilization** - Trees and shrubs live outside their natural environment and should be given proper care to maintain health and vigor. Fertilizing trees and shrubs provides the plants with nutrients needed to resist insect attack, to resist drought and to grow thicker foliage. Fertilizing of new and old trees may be done in one of three ways, in either the early spring or the late fall.

- Systemic Injection of new and existing trees on trees 2 inches or greater in diameter. You must be licensed to apply this method.

- Soil Injection – a liquid fertilizer with a product such as Arbor Green or Rapid Grow injected into the soil under the drip zone of a tree or shrub. Material must be used according to manufacturers' specifications to be effective. Outside contracting is recommended.
- Punch Bar Method – a dry fertilizer such as 10-10-10, may be used by punched holes in the drip zone of the tree 12-18" deep, two feet apart around the circumference, to the edge of the drip line. Three pounds of fertilizer should be used per diameter inch for trees with trunks six inches or more in diameter.
- Fertilizer of shrubs – use a fertilizer such as 10-10-10, broadcast over the planting area according to the manufacturers' rate and water in.
- All fertilization must be noted on daily maintenance log.

**Watering** - Trees and Shrubs will need supplemental watering to remain in vigorous health. All new plants need to be watered once a week in cool weather, twice a week during warm weather, and up to three times in a week during periods of extreme heat and drought. Trees and shrubs should be watered in such a manner as to totally saturate the soil in the root zone area. Over-watering or constant saturation of the soil must be avoided as this could lead to root rot and other disease problems. The use of a soil moisture meter can help you monitor the soil's water intake.

**Plant Replacement** - Unhealthy plants that may cause widespread infestation of other nearby plants shall be immediately removed from the site. Any vegetation removed from the site must be recorded and submitted with the daily maintenance log. The area shall be treated to prevent further infestation. The plant shall then be replaced with a healthy specimen of the same species and size. This work shall have a pre-established budget allowance for the year.

A spring inspection of all plant materials shall be performed to identify those plant materials that are not in vigorously healthy condition. Unhealthy plant materials shall be evaluated. If the problem is determined to be minor the plant material shall be given appropriate restorative care in accordance with this maintenance guideline until it is restored to a vigorously healthy condition. Unhealthy plant materials that do not respond to restorative care or are determined to be beyond saving shall be replaced with a healthy specimen of the same species and size. In the case of the necessity of replacing extremely large plant materials the Landscape Architect shall determine the size of the replacement plant.

**Pruning** - Proper pruning is the selective removal of branches without changing the plant's natural appearance, or habit of growth. All tree pruning is to be performed by a licensed Arborist. All branches that are dead, broken, scared or crossing should be removed. All cuts should be made at the collar and not cut flush with the base.

Pruning on the site shall be done for the following purposes;

- To maintain or reduce the size of a tree or shrub
- To remove dead, diseased or damaged branches
- To rejuvenate old shrubs and encourage new growth
- To stimulate future flower and fruit development
- To maximize the visibility of twig color
- To prevent damage and reduce hazards to people and properties

All shrubs are recommended to be pruned on an annual basis to prevent the shrub from becoming overgrown and eliminate the need for drastic pruning. There are several types of pruning for deciduous shrubs. Hand snips should be used to maintain a more natural look or hand shears can be used for a more formal appearance.

**Winter Protection** - All trees and shrubs are to be watered, fertilized, and mulched before the first frost. All stakes should be checked and ties adjusted. Damaged branches should be pruned.

Broadleaf and Coniferous Evergreen plant materials are to be sprayed with an anti-desiccant product to prevent winter burn. The application shall be repeated during a suitable mid-winter thaw.

Shrubs located in areas likely to be piled with snow during snow removal (but not designated as Snow Storage Areas) shall be marked by six-foot high poles with bright green banner flags. Stockpiles of snow are not to be located in these areas due to potential damage to the plant materials from both the weight of the snow and the snow melting chemicals.

At the fall landscape maintenance conference parameters will be discussed between the Landscape Maintenance Contractor and the snow removal contractor to assure minimal damage and loss of landscape amenities during the winter season.

**Seasonal Clean Up** - A thorough spring cleanup is to be performed. This includes the removal and replacement of dead or unhealthy plant materials and the cleanup of plant debris and any general debris that has accumulated over the winter season. Mulch is to be lightly raked to clean debris from the surface without removing any mulch. Twigs and debris are to be removed from the planting beds throughout the growing season.

**Mulching** - Planting beds shall be mulched with a treated shredded hardwood mulch free from dirt, debris, and insects. A sample of this mulch shall be given to the Owner for approval prior to installation.

Maintain a 2-3" maximum depth and keep free of weeds either by hand weeding or by the use of a pre-emergent weed control such as Treflan or Serfian. Seasonal re-mulching shall occur as necessary in the spring and the fall to maintain this minimum depth. When new mulch is added to the planting bed it shall be spread to create a total depth of no more than three inches. Edges should be maintained in a cleanly edged fashion.

Mulch shall not be placed directly against the trunk of any tree or shrub.

#### ***B. Groundcover and Perennials***

**Disease and Pest Management** – Pesticides and herbicides should be applied only as problems occur, with the proper chemical applied only by a trained professional or in the case of pesticide, a Certified Pesticide Applicator. Plants should be monitored weekly and treated accordingly.

**Fertilizer** – The health of the plants can be maintained or improved, and their growth encouraged by an application of complete fertilizer. Apply a fertilizer such as 4-12-4 as growth becomes apparent and before mulching. Apply to all groundcover and perennial planting areas by hand and avoid letting the fertilizer come in contact with the foliage, or use a liquid fertilizer and apply by soaking the soil. Apply according to the manufacturers' specifications.

Fertilization shall stop at the end of July.

**Water** – Groundcovers and Perennials will need supplemental watering in order to become established, healthy plants. All new plants need to be watered once a week in cool weather, twice a week during warm weather, and up to three times in a week during periods of extreme heat and drought. Until established, groundcovers and perennials should be watered in such a manner as to totally saturate the soil in the root zone area, to a depth of 6 inches. Once established, perennials shall continue to be watered as necessary to maintain them in a vigorous healthy condition. Over-watering or constant saturation of the soil must be avoided as this could lead to root rot and other disease problems. The use of a soil moisture meter can help you monitor the soil's water intake.

On-site water shall be furnished by the Owner. Hose and other watering equipment shall be furnished by the Landscape Maintenance Contractor.

**Replacement** – Any unhealthy plant/s that may cause widespread infestation of other nearby plants shall be immediately removed from the site. Any vegetation removed from the site must be recorded and submitted with the landscape maintenance log. The area shall be treated to prevent further infestation. The plant/s shall then be replaced with healthy specimen/s of the same species and size. Old Forge shall have a pre-established budget allowance for this type of replacement, each year.

Plant material that is damaged as a result of other landscape maintenance activities, such as mowing, shall be replaced with healthy specimens of the same species and size, at no additional cost to the owner.

**Deadheading** – Perennials shall be checked on a weekly basis and dead-headed once flowers have faded or as necessary based on plant type and duration of flower. Spent flowers can be pinched off with the thumb and forefinger. Continue to remove all faded flowers until Fall. All associated debris shall be removed from site daily.

**Staking** – Upright-growing perennials need support especially when in flower. Use of bamboo stakes, galvanized wire hoops or mesh may be necessary for their support. Supports should be put in place before they have become too difficult to handle. The supports should not be taller than the mature height of the perennial plant.

**Division of Perennials** – Two or three-year-old perennials are easily divided in the spring if more plants are needed. To divide, cut out the entire section of plant to be divided, including roots. The larger divisions (those with three or more shoots), can be set out immediately in their permanent location, where they can be expected to bloom the same season. Smaller divisions are best planted in an out-of-the-way planting bed until the following autumn or spring, when they can be moved to their permanent location.

**Weeding** – All planting beds should be kept weed-free. Weed either by hand or with a pre-emergent herbicide such as Treflen used according to manufacturers' specifications. Manual weeding is to be used in combination with the use of spot applications of herbicides. Both live and dead weeds are to be pulled and removed from the site.

All herbicide applications shall be documented in the Landscape Maintenance Log. The actual product label or the manufacturer's product specification sheet for the specific product shall also be included in the Log.

Only personnel with appropriate applicator licenses shall supervise and/or perform the application of pesticide products requiring a license.

**Winterizing** – Perennial gardens should be cleaned-up when growth ceases in the fall. Remove foliage of plants that normally die down to the ground. Divide and replant over-grown clumps.

#### **C.      *Lawn Areas - Turf Systems***

**Mowing** – Proper mowing is an integral part of any good turf maintenance program. Without it, the finest in fertilization, watering and other vital maintenance practices would be completely ineffective. Proper mowing will help control dicot weeds; help the turf survive during periods of extreme heat, and gain strength and vigor to resist disease and other infestations.

Mowing height – The proper mowing height will vary somewhat according to the type of grass. The most common type of seed & sod lawns contain a mixture of bluegrass, fine fescue and perennial rye, which should be mowed at 2-3 inches.

Mowing frequency – The basic rule of thumb for mowing frequency is to never remove more than 1/3 of the grass blade in one mowing. Example: if you want to mow your turf at 2 inches, you should cut it when it reaches 3 inches. Removing more than 1/2 of the grass plant at a time can put the plant into shock, thus making it more susceptible to stress disease and weed infestation.

Mowing frequency will vary with the growing season and should be set by the plant height and not a set date. It will often be necessary to mow twice a week during periods of surge growth to help maintain plant health and color. Mowing should be cut back during periods of stress.

Grass clippings should be removed whenever they are thick enough to layer the turf. The return of clippings to the soil actually adds nutrients and helps retain moisture. Heavily clumped grass clippings are a sign of infrequent mowing, calling for an adjustment in the mowing schedule.

When mowing any area, try to alternate mowing patterns. This tends to keep grass blades more erect and assures an even cut. A dull mower will cause color loss due to tearing of the turf plant, and since mowing will ultimately determine the appearance of any turf area there is an absolute necessity for a clean sharp cut.

**Weed & Pest Control and Fertilizing**- In order to maintain turf grass health, vigor color, and nutrients, fertilizer must be added to the soil. Recommendations for fertilization of lawn areas are as follows; fertilize at the rate of one (1) pound of nitrogen per thousand square feet, per year is optimum. Fertilizer should be a balanced slow release, sulfur coated type fertilizer.

**Weed Control** - All turf areas will require some weed control, for both weed grasses and dicot weeds. Weeds should be treated at the appropriate time and with a material labeled for the target weed. Please refer to the fertilizer weed and pest schedule for timing.

**Pest Control** - All turf areas will require some pest control. Pests should be treated at the appropriate time with a material labeled for the target pest. Please refer to the fertilizer, weed and pest schedule for timing.

**Lime** - A common cause for an unhealthy lawn is acidic soil. When the pH is below the neutral range (between 6-7) vital plant nutrients become fixed in the soil and cannot be absorbed by the grass plant. Lime corrects an acid soil condition, supplies calcium for plant growth and improves air and water circulation. Limestone applied at the rate of 50 lbs. per thousand square feet will adjust the soil pH one point over a period of 6-9 months.

**D. Fertilizer, Weed & Pest Control Schedule – Turf Systems**

Spring -           Fertilize one (1) pound of nitrogen per 1,000 square feet  
(April)              Pre-emergent weed grass control  
                        Broadleaf weed control

Late Spring -    Fertilize one (1) pound of nitrogen per 1,000 square feet  
(June)              Pre-emergent weed grass control  
                        Broadleaf weed control  
                        Insect Control (if needed)

\*Summer -       Fertilize one (1) pound of nitrogen per 1,000 square feet  
(August)             Broadleaf weed control (if needed)  
                        Insect Control (if needed)

Fall -              Fertilize one (1) pound of nitrogen per 1,000 square feet  
(September)

\*Omit if area is not to be irrigated

**Lawn Maintenance Task Schedule**

**MARCH (Weather permitting)**

- Clean up winter debris, sand, leaves, trash etc.
- Re-edge mulch beds, maintain at 2-3" maximum.
- Fertilize plants
- Aerate and thatch turf (conditions permitting)

**APRIL**

- Reseed or sod all areas needing attention.
- Fertilize and weed control
- Lime
- Start mowing when grass reaches 2-1/2", mow to 2"

**MAY**

- Mow turf to 2-2-1/2"
- Weed as necessary.
- Check for disease and pest problems in both turf and plants.

**JUNE**

- Mow turf to 2-1/2" – 3"
- Fertilize and weed control.
- Weed
- Check for disease and pest problems in both turf and plants, treat as necessary.

**PROVISIONS FOR SOLID WASTE MANAGEMENT (SITE TRASH)**

Trash will be placed in on-site dumpsters and the Owner will make provisions for its regular and timely removal.

**SNOW DISPOSAL AND PLOWING PLANS**

The purpose of the snow and snowmelt management plan is to provide guidelines regarding snow disposal site selection, site preparation and maintenance that are acceptable to the Department of Environmental Protection. For the areas that require snow removal, snow storage onsite will largely be accomplished by using pervious areas along the shoulder of the roadway and development as windrowed by plows.

- Avoid dumping of snow into any water body, including rivers, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid disposing of snow on top of storm drain catch basins or in stormwater basins. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.
- In significant storm events, the melting or off-site trucking of snow may be implemented. These activities shall be conducted in accordance with all local, state and federal regulations.

**WINTER ROAD SALT AND/OR SAND USE AND STORAGE RESTRICTIONS**

The applicant will be responsible for sanding and salting the site. No storage on site.

**STREET SWEEPING SCHEDULES**

There are three types of sweepers: Mechanical, Regenerative Air, and Vacuum Filter.

- 1) Mechanical: Mechanical sweepers use brooms or rotary brushes to scour the pavement.
- 2) Regenerative Air: These sweepers blow air onto the road or parking lot surface, causing fines to rise where they are vacuumed.
- 3) Vacuum filter: These sweepers remove fines along roads. Two general types of vacuum filter sweepers are available - wet and dry. The dry type uses a broom in combination with the vacuum. The wet type uses water for dust suppression

Regardless of the type chosen, the efficiency of street sweeping is increased when sweepers are operated in tandem.

This project has not included street sweeping as part of the TSS removal calculations. However, it is recommended that street sweeping of the parking areas occur four times a year, including once after the spring snow melt.

**Reuse and Disposal of Street Sweepings**

Once removed from paved surfaces, the sweepings must be handled and disposed of properly. Mass DEP's Bureau of Waste Prevention has issued a written policy regarding the reuse and disposal of street sweepings. These sweepings are regulated as a solid waste, and can be used in three ways:

- In one of the ways already approved by Mass DEP (e.g., daily cover in a landfill, additive to compost, fill in a public way)

- If approved under a Beneficial Use Determination
- Disposed in a landfill

**TRAINING OF STAFF OR PERSONNEL INVOLVED WITH IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN**

The Long-Term Pollution Prevention Plan is to be implemented by property owner of the site. Trained and, if required, licensed Professionals are to be hired by the owner as applicable to implement the Long-Term Pollution Prevention Plan.

**LIST OF EMERGENCY CONTACTS FOR IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN**

The applicant will be required to implement the Long-Term Pollution Prevention Plan and will create and maintain a list of emergency contacts.

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

**POST CONSTRUCTION PHASE INSPECTION SCHEDULE AND EVALUATION CHECKLIST**

Inspection Date	Inspector	BMP Inspected	Inspection Frequency Requirements	Comments	Recommendation	Follow-up Inspection Required (yes/no)
		Catch Basin	Four times a year			
		Water Quality Units	Four times a year			
		Infiltration System	Twice a year			
		Pipe Outlet Protection	Once a year			

1. Refer to the Massachusetts Stormwater Handbook Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspections and maintenance of specific BMP's
2. Inspections to be conducted by a qualified professional such as an environmental scientist or civil engineer.
3. Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.
4. Other Notes: (Include deviations from Conservation Commission Approvals, Planning Board Approvals and Approved Plans)

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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## **SECTION 5.0**

### **HYDROLOGY CALCULATIONS**

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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## **5.01 EXISTING WATERSHED PLAN**

THORNDIKE PLACE

DOROTHY ROAD

ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

EXISTING WATERSHED  
PLAN

NOVEMBER 3, 2020

PREPARED  
FOR:  
ARLINGTON LAND REALTY  
84 SHERMAN STREET  
CAMBRIDGE, MA



803 Summer Street  
Boston, Massachusetts  
02127

617 896 4300

LEGEND



SUBCATCHMENT



SUBCATCHMENT BOUNDARY



TIME OF CONCENTRATION FLOW  
PATH

SCALE: 1" = 60'

0 30 60

120 FEET

Job No.: 23407.00 Date: 11/3/2020

Scale: 1" = 60' Revised:

Dwg No.: EXW

File: C:\DRAINAGE DESIGN\2340700-EXW

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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**5.02 EXISTING HYDROLOGY CALCULATIONS  
(HYDROCAD™ PRINTOUTS)**

**2340700-EX**

Prepared by BSC Group

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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.021	98	Paved parking, HSG C (2S)
3.534	70	Woods, Good, HSG C (1S, 2S)
<b>3.555</b>	<b>70</b>	<b>TOTAL AREA</b>



Flow to Wetlands



Flow to Street



Routing Diagram for 2340700-EX  
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Page 3

**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.555	HSG C	1S, 2S
0.000	HSG D	
0.000	Other	
<b>3.555</b>		<b>TOTAL AREA</b>

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**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.021	0.000	0.000	0.021	Paved parking	2S
0.000	0.000	3.534	0.000	0.000	3.534	Woods, Good	1S, 2S
<b>0.000</b>	<b>0.000</b>	<b>3.555</b>	<b>0.000</b>	<b>0.000</b>	<b>3.555</b>	<b>TOTAL AREA</b>	

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Thorndike Place Pre-Development  
**Type III 24-hr 2-Year Rainfall=3.23"**  
Printed 11/3/2020  
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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Flow to Wetlands** Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>0.84"  
Flow Length=310' Tc=17.5 min CN=70 Runoff=2.1 cfs 0.238 af

**Subcatchment 2S: Flow to Street** Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>1.06"  
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.2 cfs 0.014 af

**Total Runoff Area = 3.555 ac Runoff Volume = 0.252 af Average Runoff Depth = 0.85"**  
**99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac**

Thorndike Place Pre-Development  
**Type III 24-hr 2-Year Rainfall=3.23"**  
Printed 11/3/2020  
Page 6

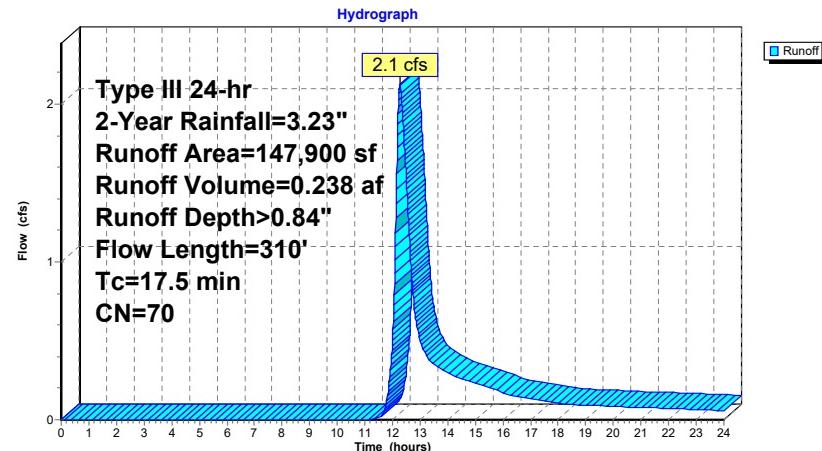
### Summary for Subcatchment 1S: Flow to Wetlands

Runoff = 2.1 cfs @ 12.27 hrs, Volume= 0.238 af, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description			
147,900	70	Woods, Good, HSG C			
147,900		100.00% Pervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		Sheet Flow, A to B Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		Shallow Concentrated Flow, B to C Woodland Kv= 5.0 fps
17.5	310	Total			

### Subcatchment 1S: Flow to Wetlands



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**Type III 24-hr 2-Year Rainfall=3.23"**  
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#### Summary for Subcatchment 2S: Flow to Street

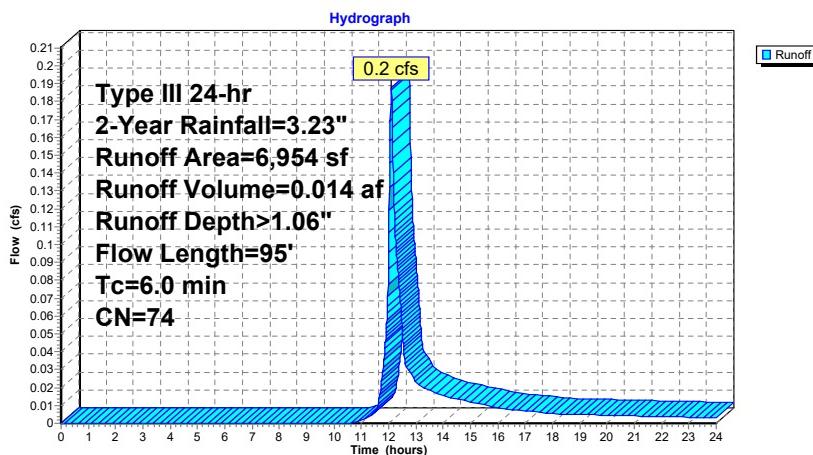
Runoff = 0.2 cfs @ 12.10 hrs, Volume= 0.014 af, Depth> 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		<b>Sheet Flow, A to B</b> Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		<b>Shallow Concentrated Flow, B to C</b> Woodland Kv= 5.0 fps
5.3	95				Total, Increased to minimum Tc = 6.0 min

#### Subcatchment 2S: Flow to Street



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**Type III 24-hr 10-Year Rainfall=4.90"**  
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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

#### Subcatchment 1S: Flow to Wetlands

Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>1.95"  
Flow Length=310' Tc=17.5 min CN=70 Runoff=5.4 cfs 0.553 af

#### Subcatchment 2S: Flow to Street

Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>2.28"  
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.4 cfs 0.030 af

**Total Runoff Area = 3.555 ac Runoff Volume = 0.583 af Average Runoff Depth = 1.97"**  
**99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac**

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Thorndike Place Pre-Development  
Type III 24-hr 10-Year Rainfall=4.90"  
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Page 9

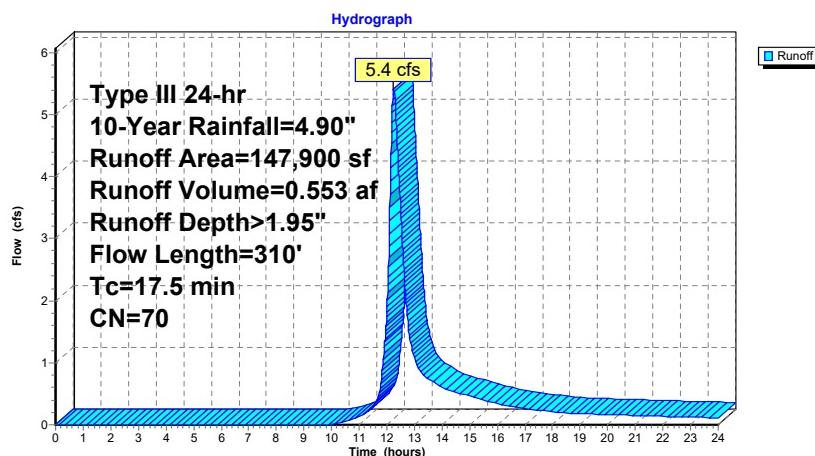
### Summary for Subcatchment 1S: Flow to Wetlands

Runoff = 5.4 cfs @ 12.25 hrs, Volume= 0.553 af, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description			
147,900	70	Woods, Good, HSG C			
147,900		100.00% Pervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)			
11.4	50	0.0240	Velocity (ft/sec)	Capacity (cfs)	Description
			Sheet Flow, A to B		
			Woods: Light underbrush	n= 0.400	P2= 3.23"
			Shallow Concentrated Flow, B to C		
			Woodland	Kv= 5.0 fps	
6.1	260	0.0200	0.71		
17.5	310	Total			

### Subcatchment 1S: Flow to Wetlands



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Thorndike Place Pre-Development  
Type III 24-hr 10-Year Rainfall=4.90"  
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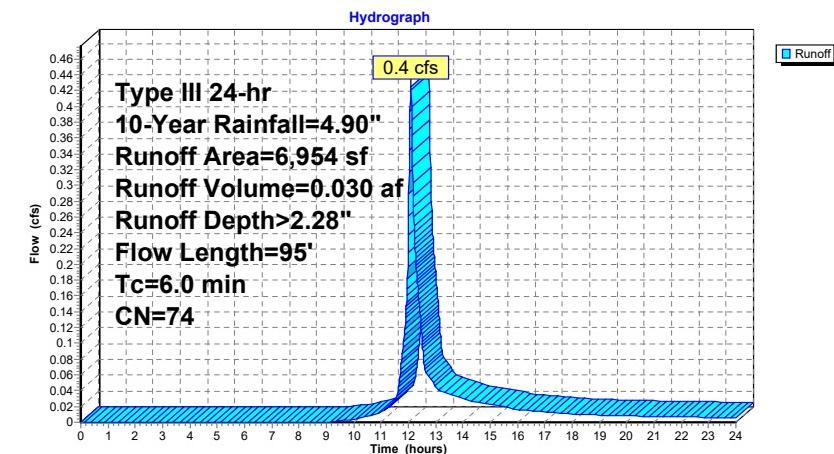
### Summary for Subcatchment 2S: Flow to Street

Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.030 af, Depth> 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description			
6,029	70	Woods, Good, HSG C			
925	98	Paved parking, HSG C			
6,954	74	Weighted Average			
6,029		86.70% Pervious Area			
925		13.30% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)			
3.5	20	0.0750	Velocity (ft/sec)	Capacity (cfs)	Description
			Sheet Flow, A to B		
			Woods: Light underbrush	n= 0.400	P2= 3.23"
			Shallow Concentrated Flow, B to C		
			Woodland	Kv= 5.0 fps	
1.8	75	0.0200	0.71		
5.3	95	Total, Increased to minimum Tc = 6.0 min			

### Subcatchment 2S: Flow to Street



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*Type III 24-hr 25-Year Rainfall=6.20"*  
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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Flow to Wetlands** Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>2.95"  
Flow Length=310' Tc=17.5 min CN=70 Runoff=8.3 cfs 0.836 af

**Subcatchment 2S: Flow to Street** Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>3.35"  
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.6 cfs 0.045 af

**Total Runoff Area = 3.555 ac Runoff Volume = 0.880 af Average Runoff Depth = 2.97"**  
**99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac**

Thorndike Place Pre-Development  
*Type III 24-hr 25-Year Rainfall=6.20"*  
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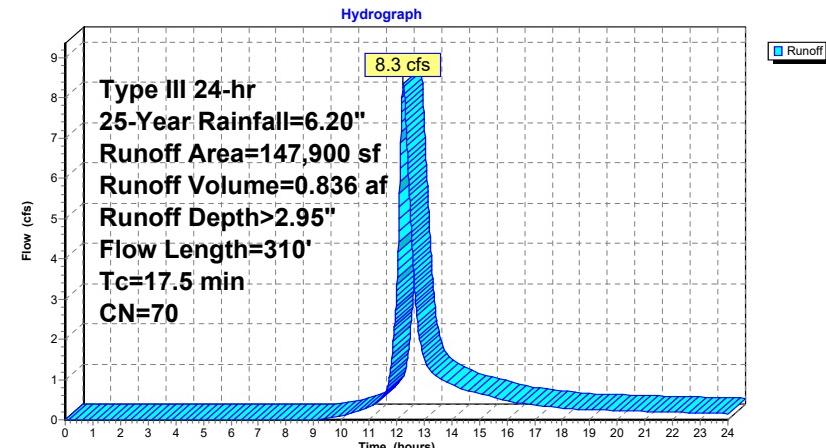
### Summary for Subcatchment 1S: Flow to Wetlands

Runoff = 8.3 cfs @ 12.24 hrs, Volume= 0.836 af, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description			
147,900	70	Woods, Good, HSG C			
147,900		100.00% Pervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		Sheet Flow, A to B Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		Shallow Concentrated Flow, B to C Woodland Kv= 5.0 fps
17.5	310	Total			

### Subcatchment 1S: Flow to Wetlands



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**Type III 24-hr 25-Year Rainfall=6.20"**  
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#### Summary for Subcatchment 2S: Flow to Street

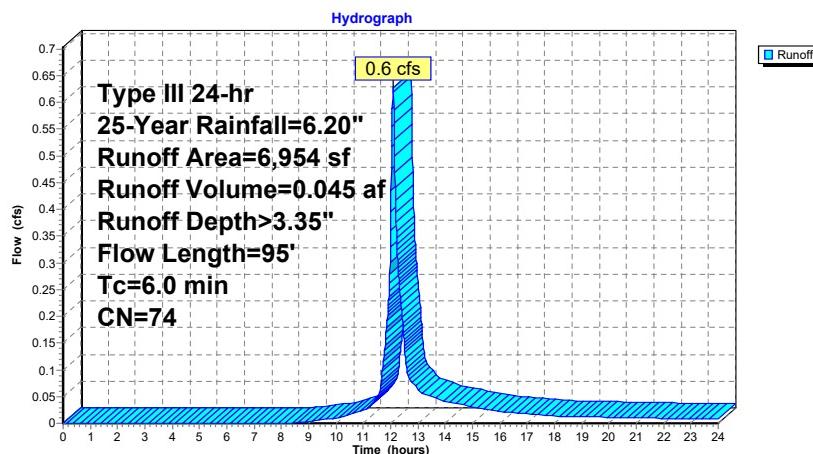
Runoff = 0.6 cfs @ 12.09 hrs, Volume= 0.045 af, Depth> 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		<b>Sheet Flow, A to B</b> Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		<b>Shallow Concentrated Flow, B to C</b> Woodland Kv= 5.0 fps
5.3	95				Total, Increased to minimum Tc = 6.0 min

#### Subcatchment 2S: Flow to Street



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Thorndike Place Pre-Development  
**Type III 24-hr 50-Year Rainfall=7.43"**  
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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

#### Subcatchment 1S: Flow to Wetlands

Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>3.96"  
Flow Length=310' Tc=17.5 min CN=70 Runoff=11.3 cfs 1.122 af

#### Subcatchment 2S: Flow to Street

Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>4.41"  
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.8 cfs 0.059 af

Total Runoff Area = 3.555 ac Runoff Volume = 1.180 af Average Runoff Depth = 3.98"  
99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac

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Type III 24-hr 50-Year Rainfall=7.43"  
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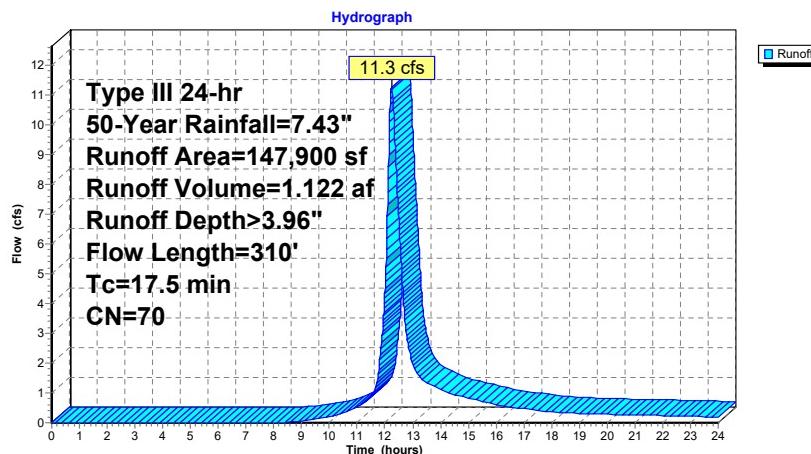
## **Summary for Subcatchment 1S: Flow to Wetlands**

Runoff = 11.3 cfs @ 12.24 hrs, Volume= 1.122 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description			
147,900	70	Woods, Good, HSG C			
147,900		100.00% Pervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		<b>Sheet Flow, A to B</b> Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		<b>Shallow Concentrated Flow, B to C</b> Woodland Kv= 5.0 fps
17.5	310	Total			

### **Subcatchment 1S: Flow to Wetlands**



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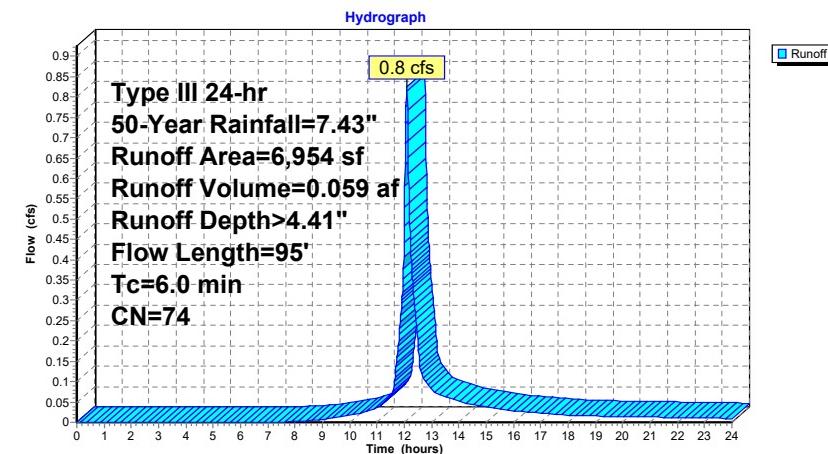
## **Summary for Subcatchment 2S: Flow to Street**

Runoff = 0.8 cfs @ 12.09 hrs, Volume= 0.059 af, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description			
6,029	70	Woods, Good, HSG C			
925	98	Paved parking, HSG C			
6,954	74	Weighted Average			
6,029		86.70% Pervious Area			
925		13.30% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		<b>Sheet Flow, A to B</b>
					Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		<b>Shallow Concentrated Flow, B to C</b>
					Woodland Kv= 5.0 fps
5.2	65	Total	Increased to minimum Tc = 6 min		

## **Subcatchment 2S: Flow to Street**



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**Type III 24-hr 100-Year Rainfall=8.89"**  
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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Flow to Wetlands** Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>5.22"  
Flow Length=310' Tc=17.5 min CN=70 Runoff=14.9 cfs 1.477 af

**Subcatchment 2S: Flow to Street** Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>5.72"  
Flow Length=95' Tc=6.0 min CN=74 Runoff=1.1 cfs 0.076 af

**Total Runoff Area = 3.555 ac Runoff Volume = 1.553 af Average Runoff Depth = 5.24"**  
**99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac**

Thorndike Place Pre-Development  
**Type III 24-hr 100-Year Rainfall=8.89"**  
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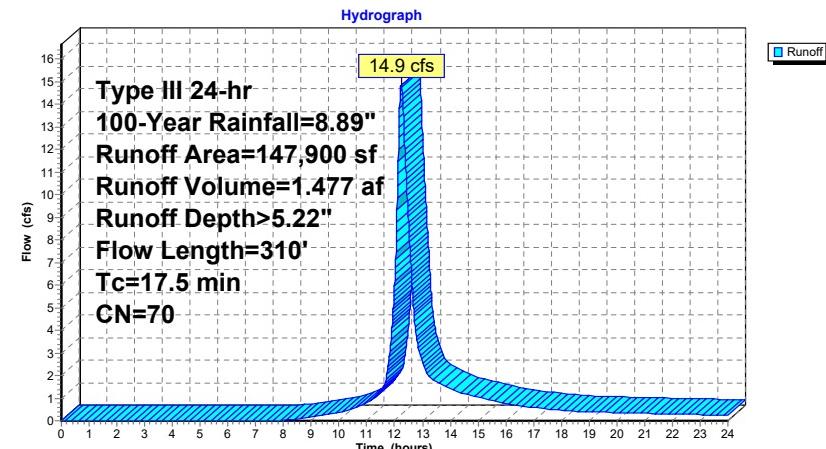
### Summary for Subcatchment 1S: Flow to Wetlands

Runoff = 14.9 cfs @ 12.23 hrs, Volume= 1.477 af, Depth> 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description			
147,900	70	Woods, Good, HSG C			
147,900		100.00% Pervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		Sheet Flow, A to B Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		Shallow Concentrated Flow, B to C Woodland Kv= 5.0 fps
17.5	310	Total			

### Subcatchment 1S: Flow to Wetlands



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**Type III 24-hr 100-Year Rainfall=8.89"**  
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### Summary for Subcatchment 2S: Flow to Street

Runoff = 1.1 cfs @ 12.09 hrs, Volume= 0.076 af, Depth> 5.72"

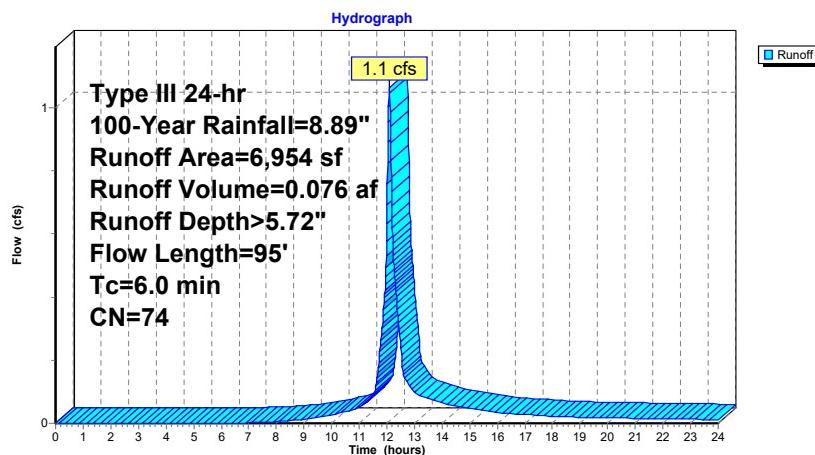
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C

6.954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		<b>Sheet Flow, A to B</b> Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		<b>Shallow Concentrated Flow, B to C</b> Woodland Kv= 5.0 fps
5.3	95				Total, Increased to minimum Tc = 6.0 min

### Subcatchment 2S: Flow to Street



**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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## **5.03 PROPOSED WATERSHED PLAN**

THORNDIKE PLACE

DOROTHY ROAD

ARLINGTON  
MASSACHUSETTS  
(MIDDLESEX COUNTY)

PROPOSED WATERSHED  
PLAN

NOVEMBER 3, 2020

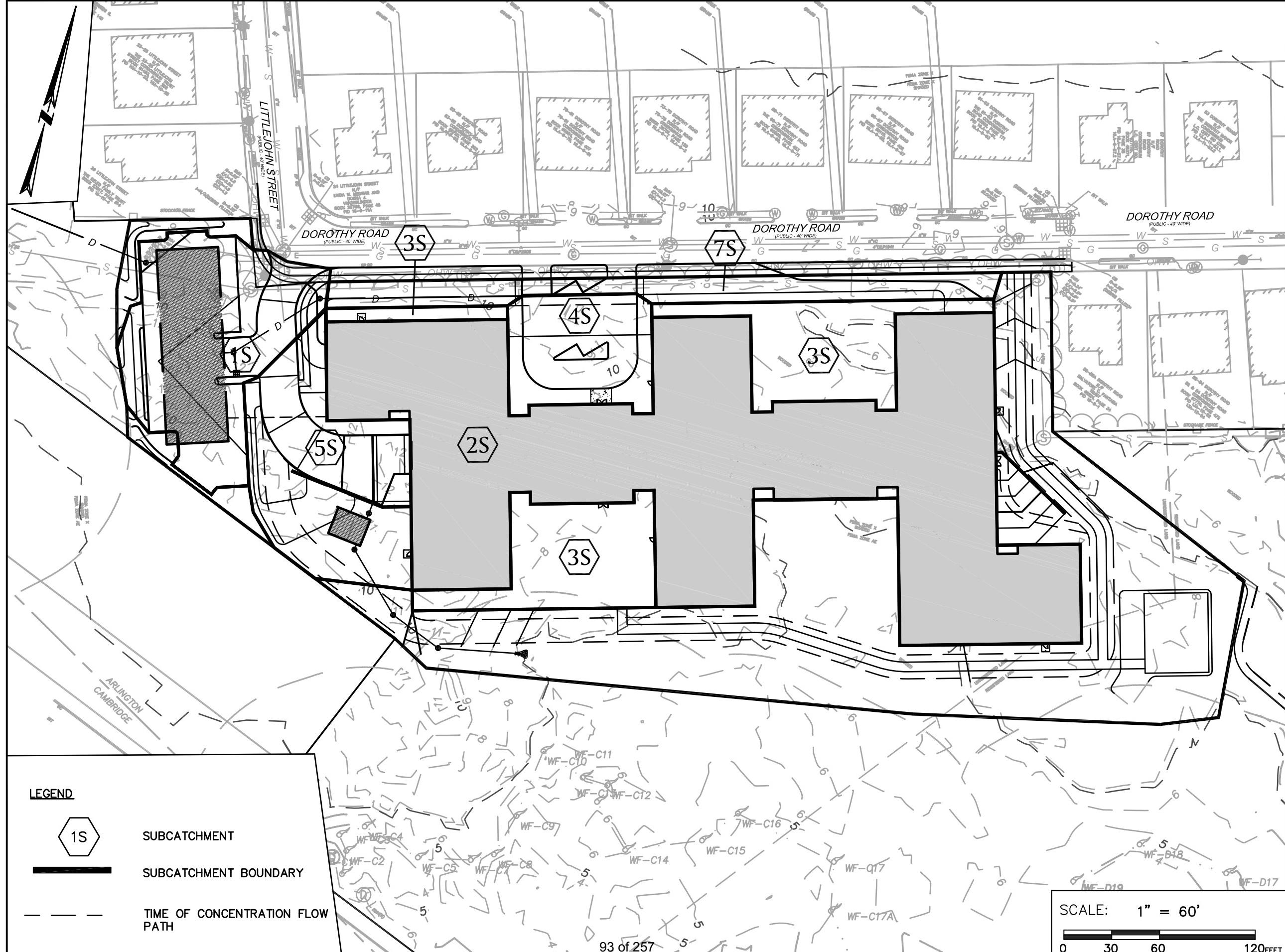
PREPARED  
FOR:  
ARLINGTON LAND REALTY  
84 SHERMAN STREET  
CAMBRIDGE, MA



803 Summer Street  
Boston, Massachusetts  
02127

617 896 4300

Job No.: 23407.00 Date: 11/3/2020  
Scale: 1" = 60' Revised: \_\_\_\_\_  
Dwg No.: PRW File: C:\DRAINAGE DESIGN\2340700-PRW



**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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**5.04 PROPOSED HYDROLOGY CALCULATIONS  
(HYDROCAD™ PRINTOUTS)**

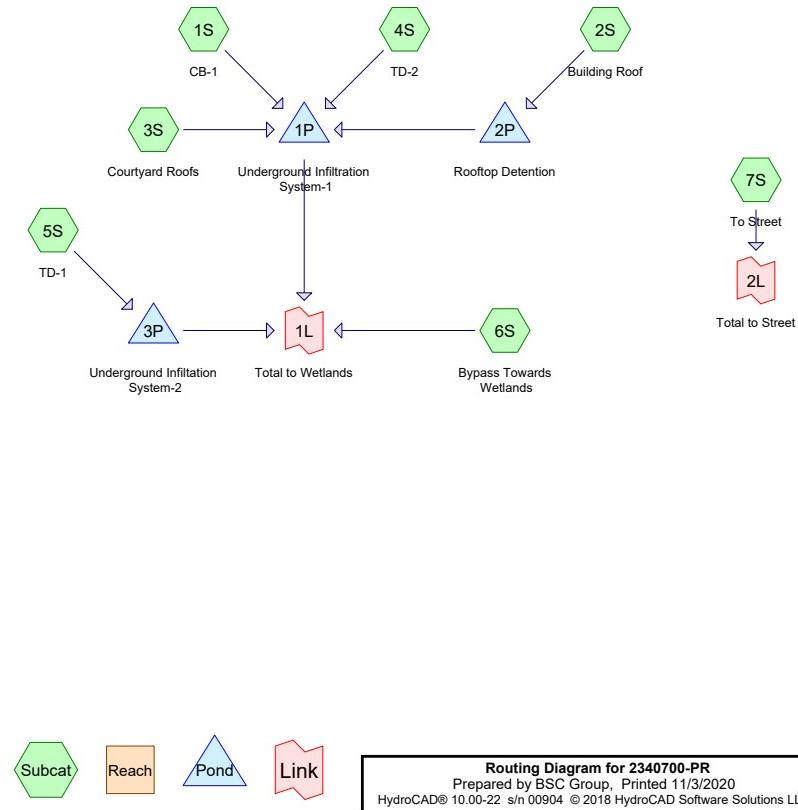
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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
1.369	74	>75% Grass cover, Good, HSG C (1S, 5S, 6S, 7S)
0.479	98	Paved parking, HSG C (1S, 4S, 5S, 7S)
1.552	98	Roofs, HSG C (2S, 3S, 5S)
0.155	70	Woods, Good, HSG C (6S)
<b>3.555</b>	<b>88</b>	<b>TOTAL AREA</b>



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**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.555	HSG C	1S, 2S, 3S, 4S, 5S, 6S, 7S
0.000	HSG D	
0.000	Other	
<b>3.555</b>	<b>TOTAL AREA</b>	

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**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.369	0.000	0.000	1.369	>75% Grass cover, Good	1S, 5S, 6S, 7S
0.000	0.000	0.479	0.000	0.000	0.479	Paved parking	1S, 4S, 5S, 7S
0.000	0.000	1.552	0.000	0.000	1.552	Roofs	2S, 3S, 5S
0.000	0.000	0.155	0.000	0.000	0.155	Woods, Good	6S
<b>0.000</b>	<b>0.000</b>	<b>3.555</b>	<b>0.000</b>	<b>0.000</b>	<b>3.555</b>	<b>TOTAL AREA</b>	

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Thorndike Place Post-Development  
 Type III 24-hr 2-Year Rainfall=3.23"  
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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: CB-1</b>	Runoff Area=13,149 sf 83.09% Impervious Runoff Depth>2.57" $T_c=6.0 \text{ min}$ CN=94 Runoff=0.9 cfs 0.065 af
<b>Subcatchment 2S: Building Roof</b>	Runoff Area=51,814 sf 100.00% Impervious Runoff Depth>2.99" $T_c=6.0 \text{ min}$ CN=98 Runoff=3.7 cfs 0.297 af
<b>Subcatchment 3S: Courtyard Roofs</b>	Runoff Area=14,820 sf 100.00% Impervious Runoff Depth>2.99" $T_c=6.0 \text{ min}$ CN=98 Runoff=1.1 cfs 0.085 af
<b>Subcatchment 4S: TD-2</b>	Runoff Area=6,330 sf 100.00% Impervious Runoff Depth>2.99" $T_c=6.0 \text{ min}$ CN=98 Runoff=0.5 cfs 0.036 af
<b>Subcatchment 5S: TD-1</b>	Runoff Area=11,872 sf 34.45% Impervious Runoff Depth>1.56" $T_c=6.0 \text{ min}$ CN=82 Runoff=0.5 cfs 0.035 af
<b>Subcatchment 6S: Bypass Towards</b>	Runoff Area=50,395 sf 0.00% Impervious Runoff Depth>1.00" $T_c=0.0 \text{ min}$ CN=73 Runoff=1.6 cfs 0.097 af
<b>Subcatchment 7S: To Street</b>	Runoff Area=6,474 sf 7.57% Impervious Runoff Depth>1.17" $T_c=6.0 \text{ min}$ CN=76 Runoff=0.2 cfs 0.015 af
<b>Pond 1P: Underground Infiltration System-1</b>	Peak Elev=6.51' Storage=6,223 cf Inflow=2.4 cfs 0.186 af Discarded=0.0 cfs 0.044 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.044 af
<b>Pond 2P: Rooftop Detention</b>	Peak Elev=57.34' Storage=12,931 cf Inflow=3.7 cfs 0.297 af 12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.0 cfs 0.000 af
<b>Pond 3P: Underground Infiltration System-2</b>	Peak Elev=8.40' Storage=449 cf Inflow=0.5 cfs 0.035 af 12.0" Round Culvert n=0.013 L=44.0' S=0.0050 '/' Outflow=0.5 cfs 0.025 af
<b>Link 1L: Total to Wetlands</b>	Inflow=1.6 cfs 0.122 af Primary=1.6 cfs 0.122 af
<b>Link 2L: Total to Street</b>	Inflow=0.2 cfs 0.015 af Primary=0.2 cfs 0.015 af
<b>Total Runoff Area = 3.555 ac Runoff Volume = 0.629 af Average Runoff Depth = 2.12"</b> <b>42.87% Pervious = 1.524 ac 57.13% Impervious = 2.031 ac</b>	

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 Type III 24-hr 2-Year Rainfall=3.23"  
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### Summary for Subcatchment 1S: CB-1

Runoff = 0.9 cfs @ 12.08 hrs, Volume= 0.065 af, Depth> 2.57"

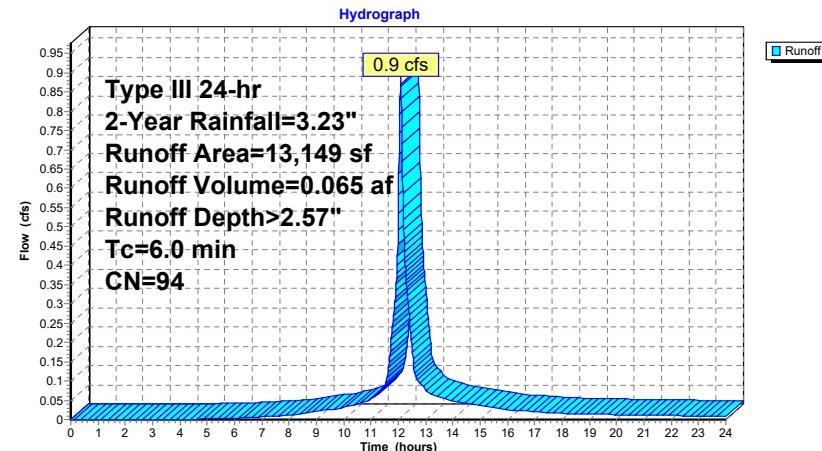
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
10,925	98	Paved parking, HSG C
2,224	74	>75% Grass cover, Good, HSG C
13,149	94	Weighted Average
2,224		16.91% Pervious Area
10,925		83.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 1S: CB-1



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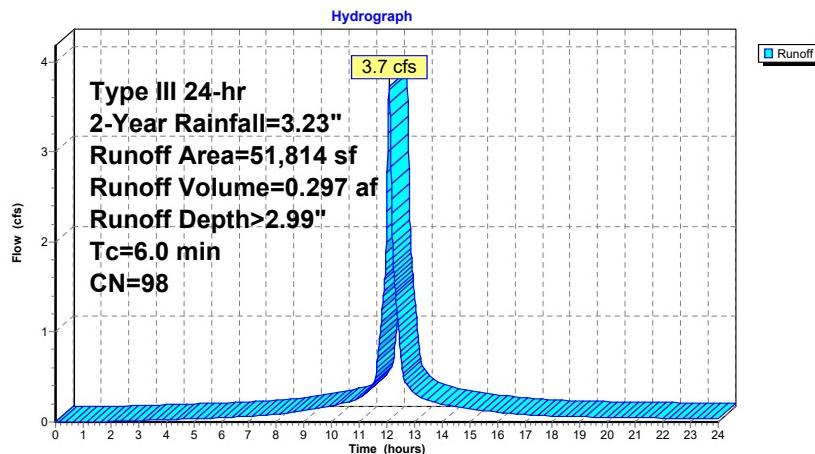
### Summary for Subcatchment 2S: Building Roof

Runoff = 3.7 cfs @ 12.08 hrs, Volume= 0.297 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description			
51,814	98	Roofs, HSG C			
51,814		100.00% Impervious Area			
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 2S: Building Roof



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Type III 24-hr 2-Year Rainfall=3.23"  
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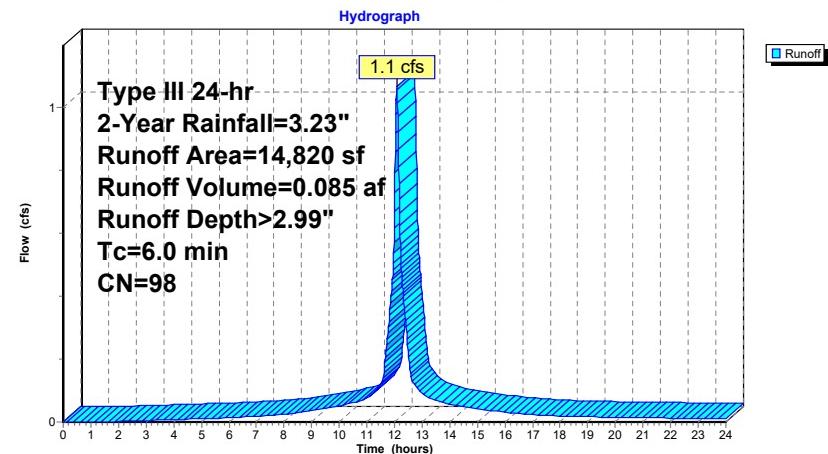
### Summary for Subcatchment 3S: Courtyard Roofs

Runoff = 1.1 cfs @ 12.08 hrs, Volume= 0.085 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description			
14,820	98	Roofs, HSG C			
14,820		100.00% Impervious Area			
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 3S: Courtyard Roofs



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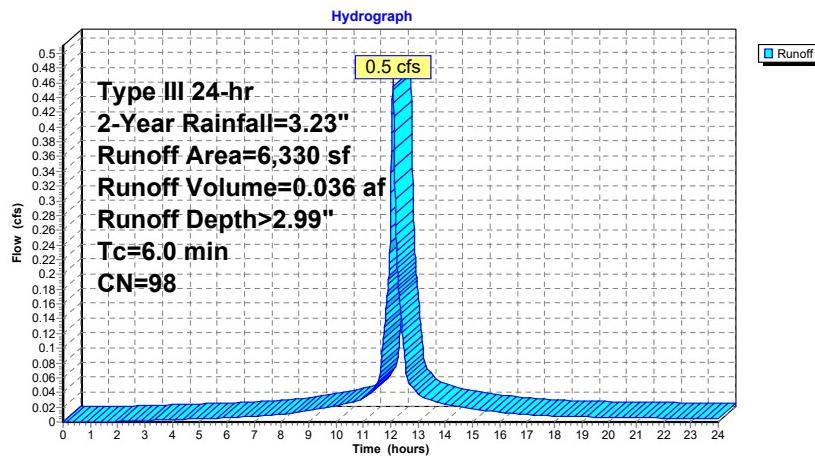
### Summary for Subcatchment 4S: TD-2

Runoff = 0.5 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description			
6,330	98	Paved parking, HSG C			
6,330		100.00% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 4S: TD-2



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 Type III 24-hr 2-Year Rainfall=3.23"  
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### Summary for Subcatchment 5S: TD-1

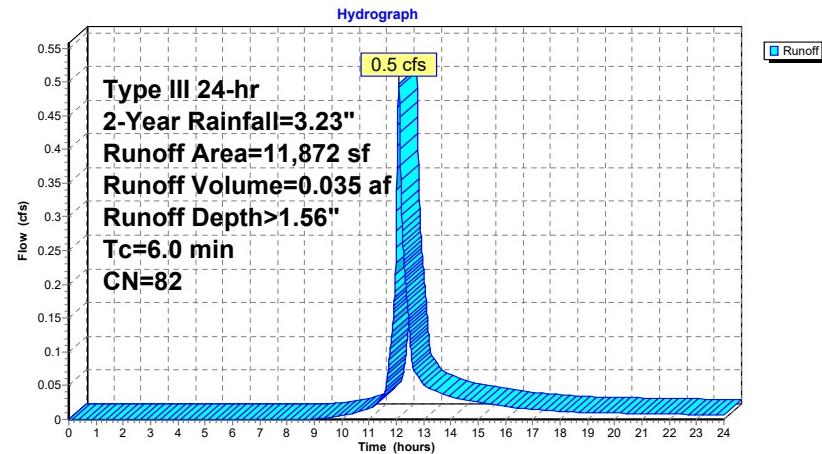
Runoff = 0.5 cfs @ 12.09 hrs, Volume= 0.035 af, Depth> 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
980	98	Roofs, HSG C
3,110	98	Paved parking, HSG C
7,782	74	>75% Grass cover, Good, HSG C
11,872	82	Weighted Average
7,782		65.55% Pervious Area
4,090		34.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 5S: TD-1



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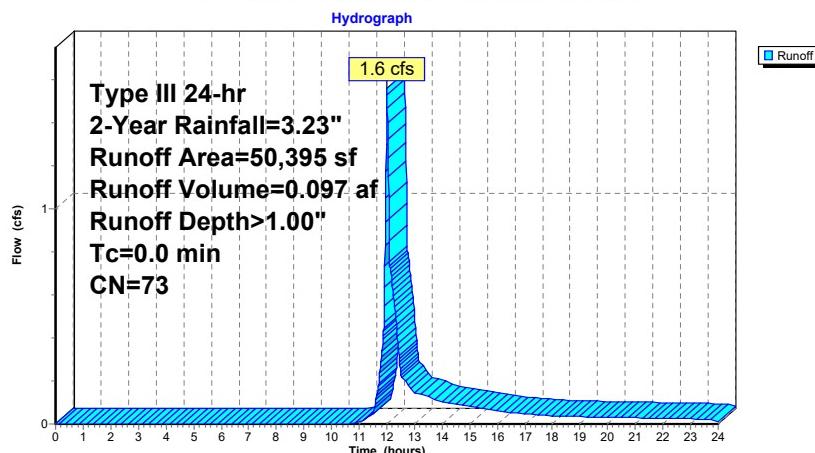
### Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 1.6 cfs @ 12.00 hrs, Volume= 0.097 af, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
50,395	73	Weighted Average
50,395		100.00% Pervious Area

### Subcatchment 6S: Bypass Towards Wetlands



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Type III 24-hr 2-Year Rainfall=3.23"  
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### Summary for Subcatchment 7S: To Street

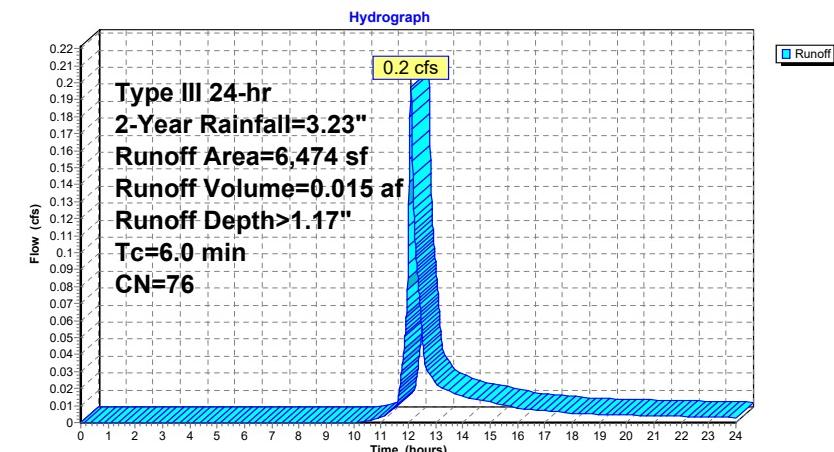
Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.015 af, Depth> 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
490	98	Paved parking, HSG C
5,984	74	>75% Grass cover, Good, HSG C
6,474	76	Weighted Average
5,984		92.43% Pervious Area
490		7.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 7S: To Street



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 Type III 24-hr 2-Year Rainfall=3.23"  
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### Summary for Pond 1P: Underground Infiltration System-1

Inflow Area = 1.977 ac, 97.42% Impervious, Inflow Depth > 1.13" for 2-Year event  
 Inflow = 2.4 cfs @ 12.08 hrs, Volume= 0.186 af  
 Outflow = 0.0 cfs @ 8.21 hrs, Volume= 0.044 af, Atten= 99%, Lag= 0 min  
 Discarded = 0.0 cfs @ 8.21 hrs, Volume= 0.044 af  
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 6.51' @ 21.34 hrs Surf.Area= 4,692 sf Storage= 6,223 cf

Plug-Flow detention time= 329.0 min calculated for 0.044 af (24% of inflow)  
 Center-of-Mass det. time= 126.7 min ( 893.0 - 766.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	5.00'	0 cf	<b>38.75'W x 121.08'L x 3.00'H Field A</b> 14,076 cf Overall - 14,076 cf Embedded = 0 cf x 40.0% Voids
#2A	5.00'	10,260 cf	<b>StormTrap ST2 SingleTrap 2-6 x 21 Inside #1</b> Inside= 101.7" W x 30.0"H => 18.82 sf x 15.40'L = 289.8 cf Outside= 101.7" W x 36.0"H => 25.44 sf x 15.40'L = 391.6 cf 3 Rows of 7 Chambers
#3	5.00'	141 cf	<b>6.00'D x 5.00'H OCS-1-Impervious</b> 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System

10,401 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	7.20'	<b>15.0" Round Culvert</b> L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.20' / 6.55' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

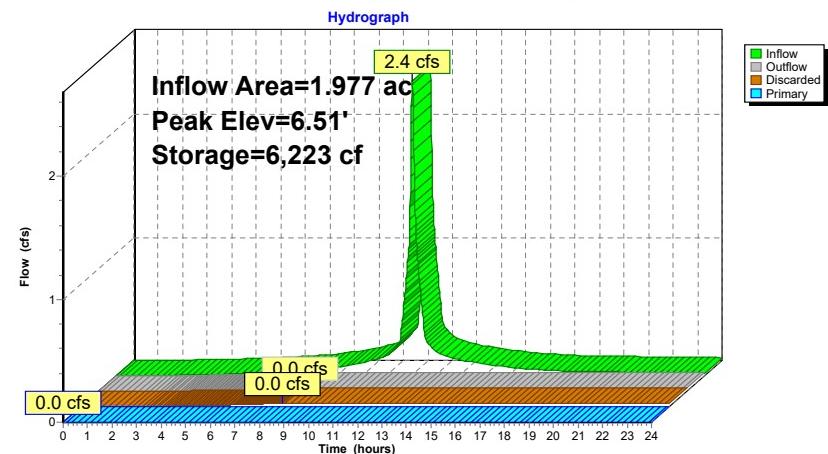
**Discarded OutFlow** Max=0.0 cfs @ 8.21 hrs HW=5.05' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.0 cfs)

**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=5.00' (Free Discharge)  
 ↑2=Culvert (Controls 0.0 cfs)

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### Pond 1P: Underground Infiltration System-1



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### Summary for Pond 2P: Rooftop Detention

Inflow Area = 1.189 ac, 100.00% Impervious, Inflow Depth > 2.99" for 2-Year event  
Inflow = 3.7 cfs @ 12.08 hrs, Volume= 0.297 af  
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min  
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Peak Elev= 57.34' @ 24.00 hrs Surf.Area= 38,000 sf Storage= 12,931 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	Rooftop Detention (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

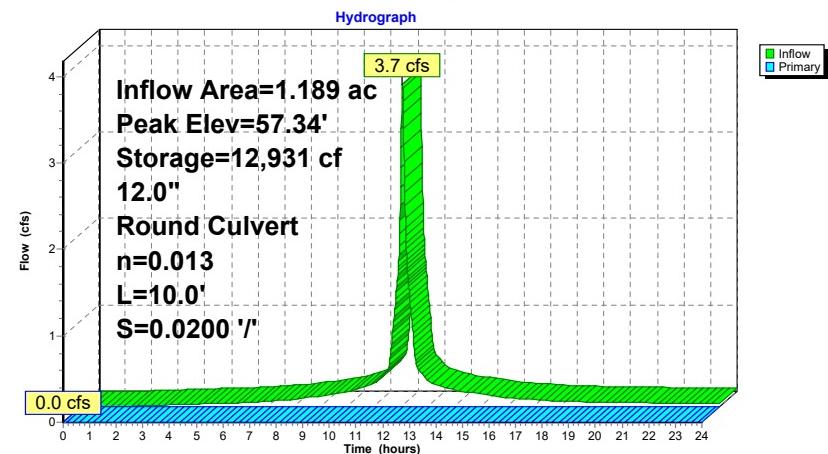
Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	12.0" Round Roof Drain L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 58.00' / 57.80' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=57.00' (Free Discharge)  
↑=Roof Drain (Controls 0.0 cfs)

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### Pond 2P: Rooftop Detention



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### Summary for Pond 3P: Underground Infiltration System-2

Inflow Area = 0.273 ac, 34.45% Impervious, Inflow Depth > 1.56" for 2-Year event  
 Inflow = 0.5 cfs @ 12.09 hrs, Volume= 0.035 af  
 Outflow = 0.5 cfs @ 12.12 hrs, Volume= 0.025 af, Atten= 0%, Lag= 2.0 min  
 Primary = 0.5 cfs @ 12.12 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 8.40' @ 12.12 hrs Surf.Area= 388 sf Storage= 449 cf

Plug-Flow detention time= 150.1 min calculated for 0.025 af (71% of inflow)  
 Center-of-Mass det. time= 54.0 min ( 889.0 - 835.0 )

Volume	Invert	Avail.Storage	Description
#1A	3.00'	204 cf	<b>21.50'W x 17.44'L x 1.83'H Field A</b> 687 cf Overall - 177 cf Embedded = 511 cf x 40.0% Voids
#2A	3.00'	177 cf	<b>ADS_StormTech SC-310 +Cap x 12 Inside #1</b> Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 6 Rows of 2 Chambers
#3	3.00'	75 cf	<b>4.00'D x 6.00'H OCS</b> 457 cf Total Available Storage

Storage Group A created with Chamber Wizard

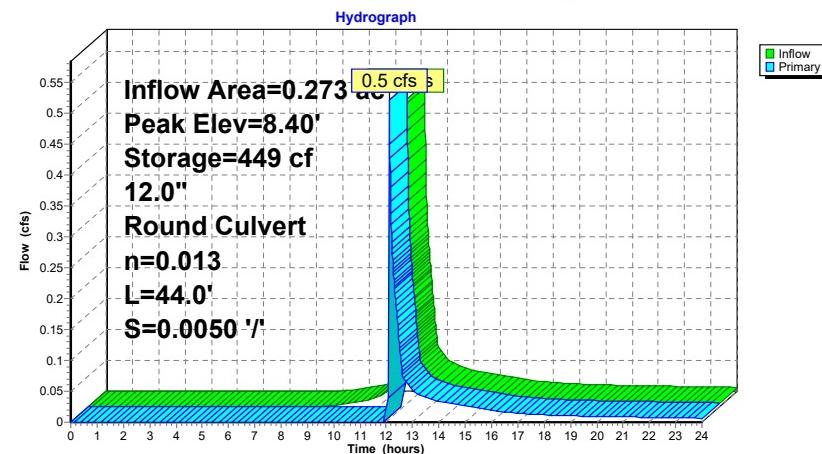
Device	Routing	Invert	Outlet Devices
#1	Primary	8.00'	<b>12.0" Round Culvert</b> L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.78' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.5 cfs @ 12.12 hrs HW=8.40' (Free Discharge)  
 ↑=Culvert (Barrel Controls 0.5 cfs @ 2.33 fps)

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### Pond 3P: Underground Infiltration System-2



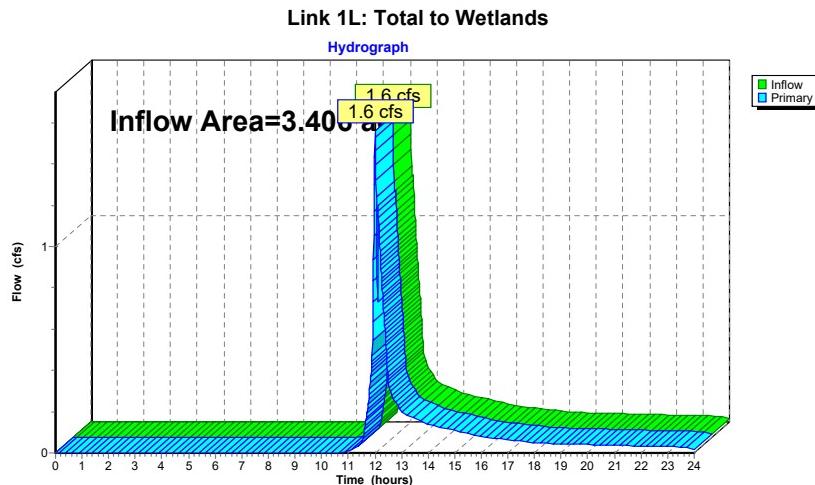
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#### Summary for Link 1L: Total to Wetlands

Inflow Area = 3.406 ac, 59.29% Impervious, Inflow Depth > 0.43" for 2-Year event  
Inflow = 1.6 cfs @ 12.00 hrs, Volume= 0.122 af  
Primary = 1.6 cfs @ 12.00 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



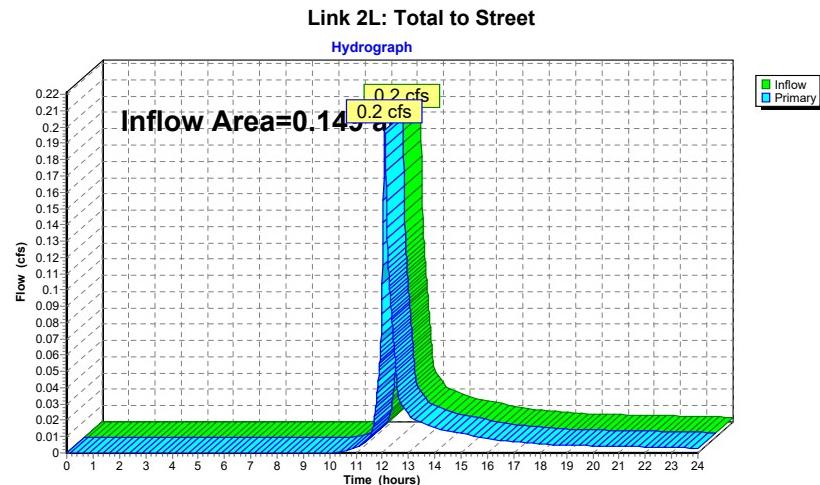
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#### Summary for Link 2L: Total to Street

Inflow Area = 0.149 ac, 7.57% Impervious, Inflow Depth > 1.17" for 2-Year event  
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.015 af  
Primary = 0.2 cfs @ 12.09 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: CB-1</b>	Runoff Area=13,149 sf 83.09% Impervious Runoff Depth>4.21" $T_c=6.0 \text{ min } CN=94$ Runoff=1.4 cfs 0.106 af
<b>Subcatchment 2S: Building Roof</b>	Runoff Area=51,814 sf 100.00% Impervious Runoff Depth>4.66" $T_c=6.0 \text{ min } CN=98$ Runoff=5.7 cfs 0.462 af
<b>Subcatchment 3S: Courtyard Roofs</b>	Runoff Area=14,820 sf 100.00% Impervious Runoff Depth>4.66" $T_c=6.0 \text{ min } CN=98$ Runoff=1.6 cfs 0.132 af
<b>Subcatchment 4S: TD-2</b>	Runoff Area=6,330 sf 100.00% Impervious Runoff Depth>4.66" $T_c=6.0 \text{ min } CN=98$ Runoff=0.7 cfs 0.056 af
<b>Subcatchment 5S: TD-1</b>	Runoff Area=11,872 sf 34.45% Impervious Runoff Depth>2.99" $T_c=6.0 \text{ min } CN=82$ Runoff=1.0 cfs 0.068 af
<b>Subcatchment 6S: Bypass Towards</b>	Runoff Area=50,395 sf 0.00% Impervious Runoff Depth>2.20" $T_c=0.0 \text{ min } CN=73$ Runoff=3.6 cfs 0.212 af
<b>Subcatchment 7S: To Street</b>	Runoff Area=6,474 sf 7.57% Impervious Runoff Depth>2.45" $T_c=6.0 \text{ min } CN=76$ Runoff=0.4 cfs 0.030 af
<b>Pond 1P: Underground Infiltration System-1</b>	Peak Elev=7.34' Storage=9,685 cf Inflow=3.7 cfs 0.294 af Discarded=0.0 cfs 0.048 af Primary=0.1 cfs 0.032 af Outflow=0.1 cfs 0.080 af
<b>Pond 2P: Rooftop Detention</b>	Peak Elev=57.53' Storage=20,119 cf Inflow=5.7 cfs 0.462 af 12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.0 cfs 0.000 af
<b>Pond 3P: Underground Infiltration System-2</b>	Peak Elev=8.60' Storage=451 cf Inflow=1.0 cfs 0.068 af 12.0" Round Culvert n=0.013 L=44.0' S=0.0050 '/' Outflow=1.0 cfs 0.058 af
<b>Link 1L: Total to Wetlands</b>	Inflow=4.2 cfs 0.302 af Primary=4.2 cfs 0.302 af
<b>Link 2L: Total to Street</b>	Inflow=0.4 cfs 0.030 af Primary=0.4 cfs 0.030 af
<b>Total Runoff Area = 3.555 ac Runoff Volume = 1.067 af Average Runoff Depth = 3.60"</b> <b>42.87% Pervious = 1.524 ac 57.13% Impervious = 2.031 ac</b>	

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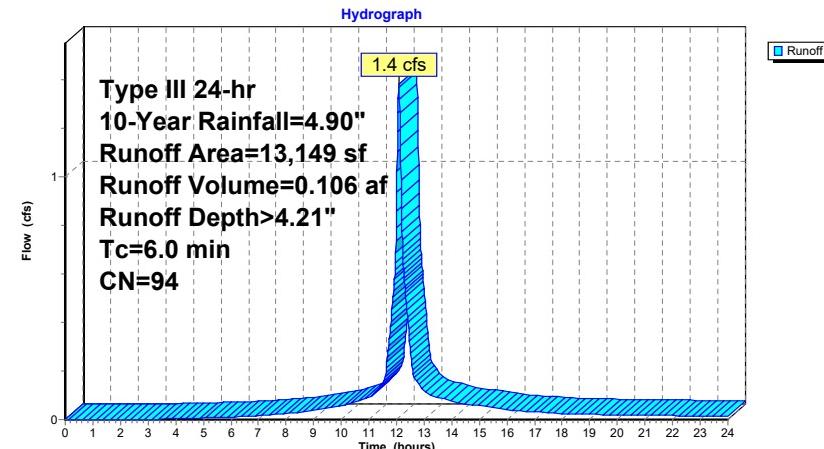
### Summary for Subcatchment 1S: CB-1

Runoff = 1.4 cfs @ 12.08 hrs, Volume= 0.106 af, Depth> 4.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description		
10,925	98	Paved parking, HSG C		
2,224	74	>75% Grass cover, Good, HSG C		
13,149	94	Weighted Average		
2,224		16.91% Pervious Area		
10,925		83.09% Impervious Area		
Tc (min)	Length (feet)	Slope (ft/ft) Velocity (ft/sec) Capacity (cfs) Description		
6.0				Direct Entry, Min. Tc

### Subcatchment 1S: CB-1



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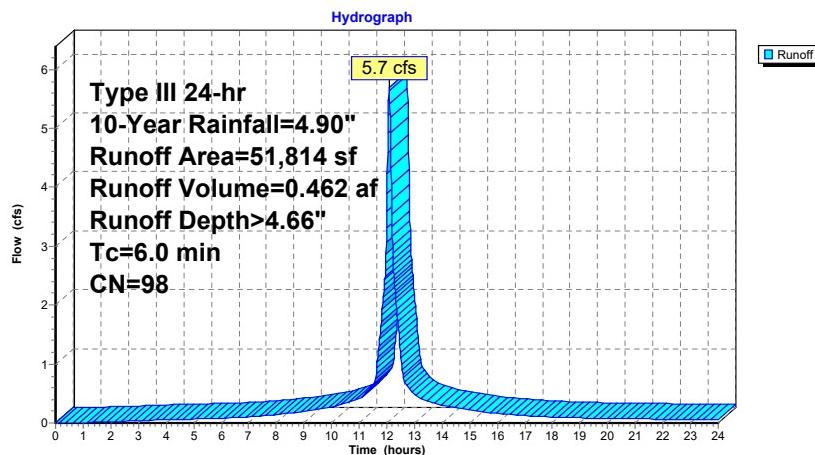
### Summary for Subcatchment 2S: Building Roof

Runoff = 5.7 cfs @ 12.08 hrs, Volume= 0.462 af, Depth> 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description			
51,814	98	Roofs, HSG C			
51,814		100.00% Impervious Area			
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 2S: Building Roof



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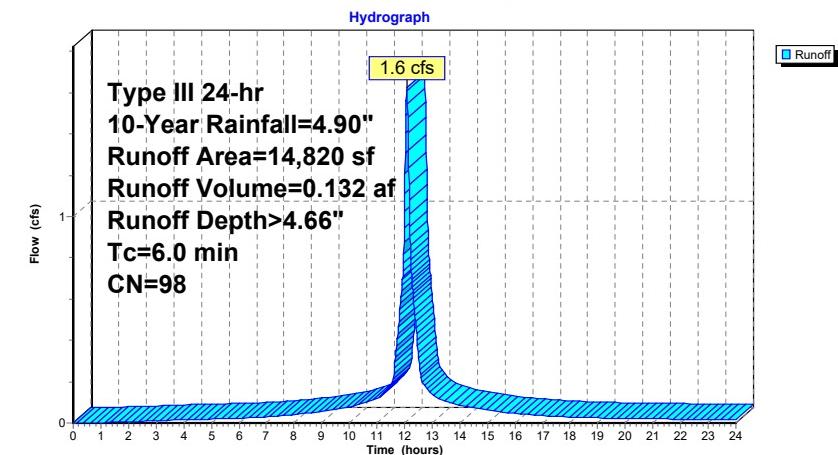
### Summary for Subcatchment 3S: Courtyard Roofs

Runoff = 1.6 cfs @ 12.08 hrs, Volume= 0.132 af, Depth> 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description			
14,820	98	Roofs, HSG C			
14,820		100.00% Impervious Area			
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 3S: Courtyard Roofs



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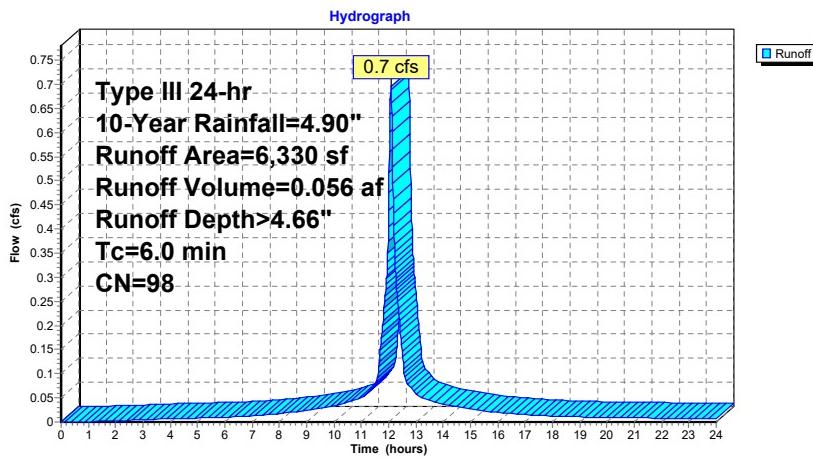
### Summary for Subcatchment 4S: TD-2

Runoff = 0.7 cfs @ 12.08 hrs, Volume= 0.056 af, Depth> 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description			
6,330	98	Paved parking, HSG C			
6,330		100.00% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 4S: TD-2



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### Summary for Subcatchment 5S: TD-1

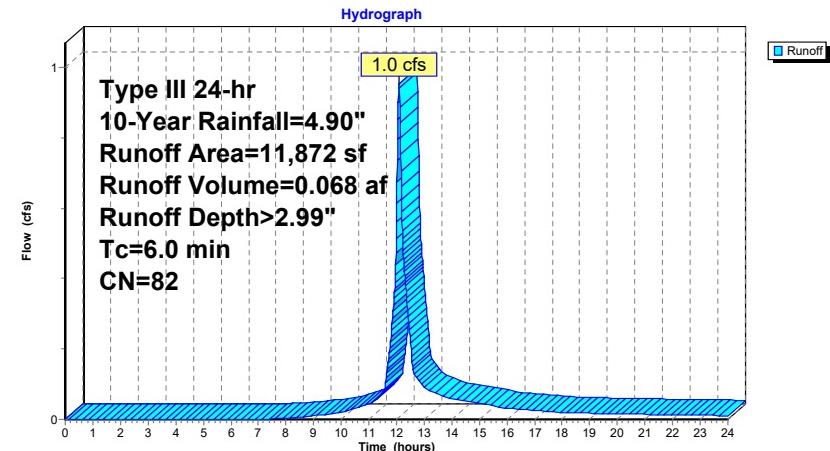
Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.068 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
980	98	Roofs, HSG C
3,110	98	Paved parking, HSG C
7,782	74	>75% Grass cover, Good, HSG C
11,872	82	Weighted Average
7,782		65.55% Pervious Area
4,090		34.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 5S: TD-1



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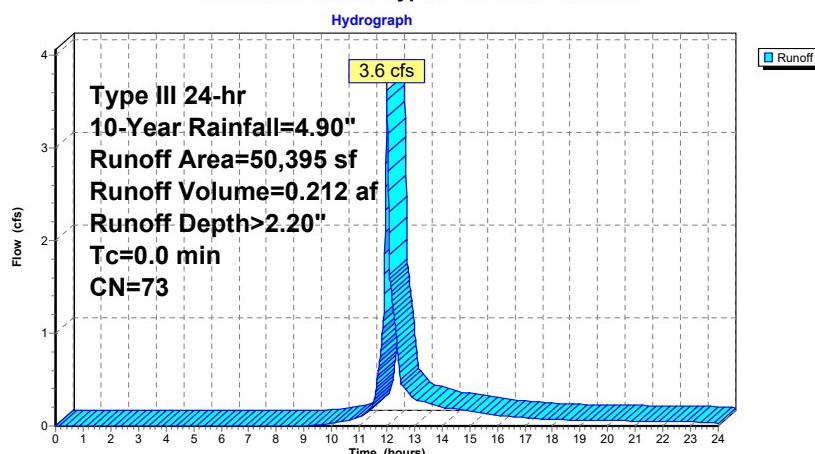
### Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 3.6 cfs @ 12.00 hrs, Volume= 0.212 af, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
50,395	73	Weighted Average
50,395		100.00% Pervious Area

### Subcatchment 6S: Bypass Towards Wetlands



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### Summary for Subcatchment 7S: To Street

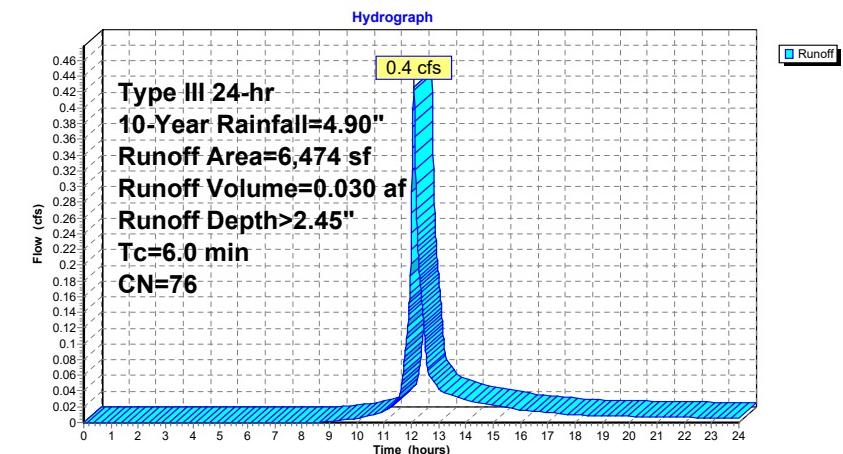
Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.030 af, Depth> 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
490	98	Paved parking, HSG C
5,984	74	>75% Grass cover, Good, HSG C
6,474	76	Weighted Average
5,984		92.43% Pervious Area
490		7.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 7S: To Street



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### Summary for Pond 1P: Underground Infiltration System-1

Inflow Area = 1.977 ac, 97.42% Impervious, Inflow Depth > 1.79" for 10-Year event  
 Inflow = 3.7 cfs @ 12.08 hrs, Volume= 0.294 af  
 Outflow = 0.1 cfs @ 16.13 hrs, Volume= 0.080 af, Atten= 97%, Lag= 243.0 min  
 Discarded = 0.0 cfs @ 6.28 hrs, Volume= 0.048 af  
 Primary = 0.1 cfs @ 16.13 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 7.34' @ 16.13 hrs Surf.Area= 4,692 sf Storage= 9,685 cf

Plug-Flow detention time= 382.7 min calculated for 0.080 af (27% of inflow)  
 Center-of-Mass det. time= 185.0 min (942.1 - 757.0 )

Volume	Invert	Avail.Storage	Description
#1A	5.00'	0 cf	<b>38.75'W x 121.08'L x 3.00'H Field A</b> 14,076 cf Overall - 14,076 cf Embedded = 0 cf x 40.0% Voids
#2A	5.00'	10,260 cf	<b>StormTrap ST2 SingleTrap 2-6 x 21 Inside #1</b> Inside= 101.7" W x 30.0"H => 18.82 sf x 15.40'L = 289.8 cf Outside= 101.7" W x 36.0"H => 25.44 sf x 15.40'L = 391.6 cf 3 Rows of 7 Chambers
#3	5.00'	141 cf	<b>6.00'D x 5.00'H OCS-1-Impervious</b> 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System

10,401 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	<b>0.270 in/hr Exfiltration over Surface area</b> <b>15.0" Round Culvert</b>
#2	Primary	7.20'	L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.20' / 6.55' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

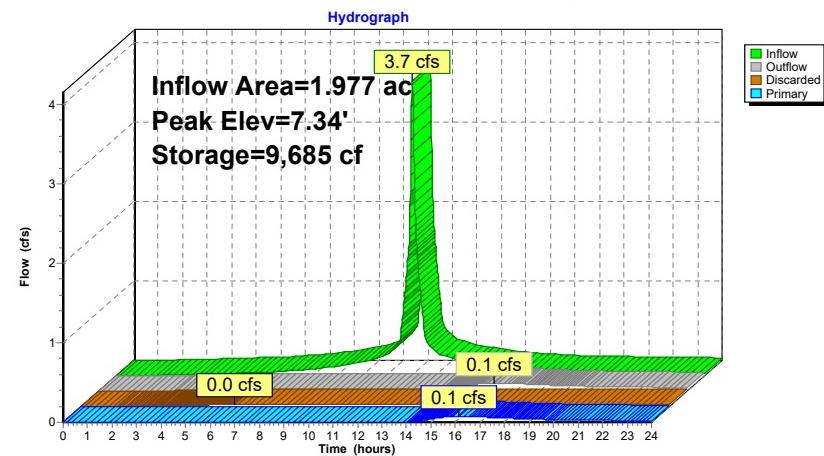
**Discarded OutFlow** Max=0.0 cfs @ 6.28 hrs HW=5.05' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.0 cfs)

**Primary OutFlow** Max=0.1 cfs @ 16.13 hrs HW=7.34' (Free Discharge)  
 ↑2=Culvert (Barrel Controls 0.1 cfs @ 1.35 fps)

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### Pond 1P: Underground Infiltration System-1



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### Summary for Pond 2P: Rooftop Detention

Inflow Area = 1.189 ac, 100.00% Impervious, Inflow Depth > 4.66" for 10-Year event  
Inflow = 5.7 cfs @ 12.08 hrs, Volume= 0.462 af  
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min  
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Peak Elev= 57.53' @ 24.00 hrs Surf.Area= 38,000 sf Storage= 20,119 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	Rooftop Detention (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

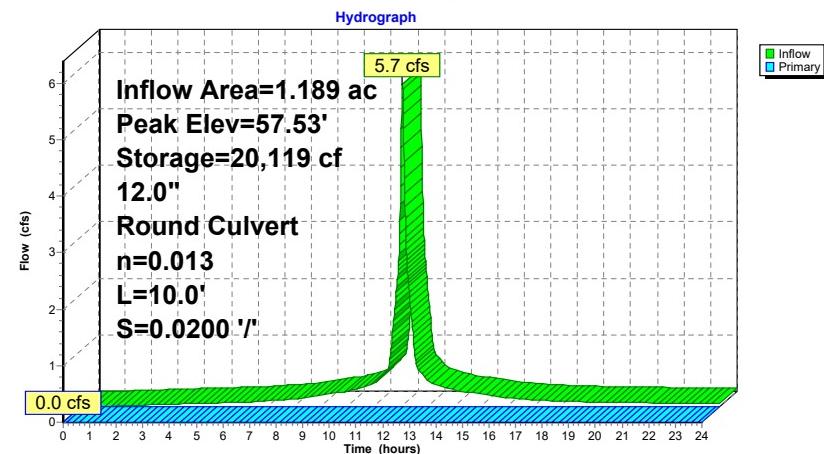
Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	<b>12.0" Round Roof Drain</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 58.00' / 57.80' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=57.00' (Free Discharge)  
↑=Roof Drain (Controls 0.0 cfs)

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### Pond 2P: Rooftop Detention



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### Summary for Pond 3P: Underground Infiltration System-2

Inflow Area = 0.273 ac, 34.45% Impervious, Inflow Depth > 2.99" for 10-Year event  
 Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.068 af  
 Outflow = 1.0 cfs @ 12.09 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.1 min  
 Primary = 1.0 cfs @ 12.09 hrs, Volume= 0.058 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 8.60' @ 12.09 hrs Surf.Area= 388 sf Storage= 451 cf

Plug-Flow detention time= 93.6 min calculated for 0.058 af (85% of inflow)  
 Center-of-Mass det. time= 29.4 min (845.9 - 816.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	3.00'	204 cf	<b>21.50'W x 17.44'L x 1.83'H Field A</b> 687 cf Overall - 177 cf Embedded = 511 cf x 40.0% Voids
#2A	3.00'	177 cf	<b>ADS_StormTech SC-310 +Cap x 12 Inside #1</b> Effective Size= 28.9"W x 16.0'H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0'H x 7.56'L with 0.44' Overlap 6 Rows of 2 Chambers
#3	3.00'	75 cf	<b>4.00'D x 6.00'H OCS</b> 457 cf Total Available Storage

Storage Group A created with Chamber Wizard

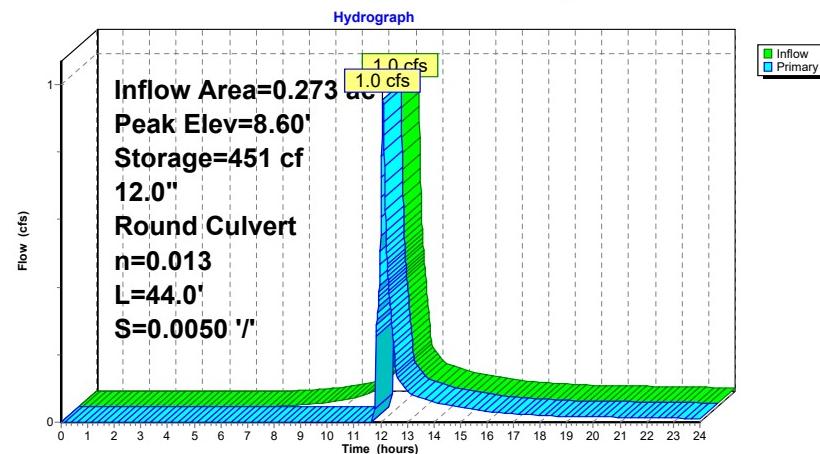
Device	Routing	Invert	Outlet Devices
#1	Primary	8.00'	<b>12.0" Round Culvert</b> L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.78' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.0 cfs @ 12.09 hrs HW=8.60' (Free Discharge)  
 ↑=Culvert (Barrel Controls 1.0 cfs @ 2.80 fps)

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### Pond 3P: Underground Infiltration System-2



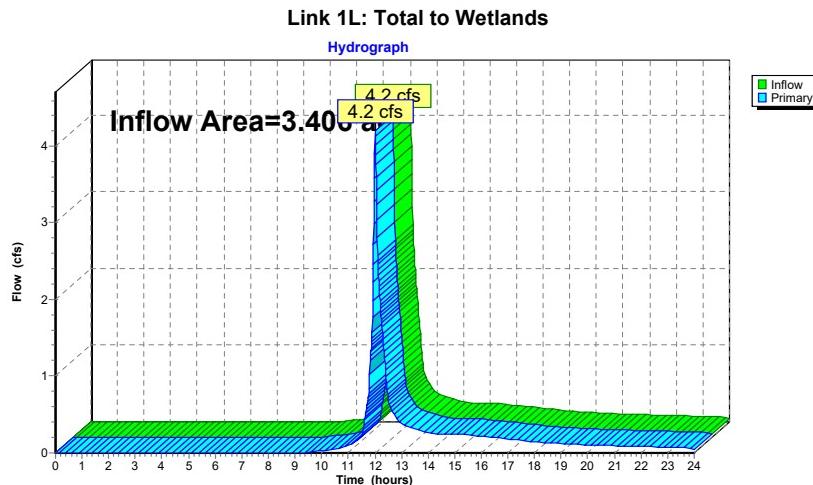
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#### Summary for Link 1L: Total to Wetlands

Inflow Area = 3.406 ac, 59.29% Impervious, Inflow Depth > 1.06" for 10-Year event  
Inflow = 4.2 cfs @ 12.00 hrs, Volume= 0.302 af  
Primary = 4.2 cfs @ 12.00 hrs, Volume= 0.302 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



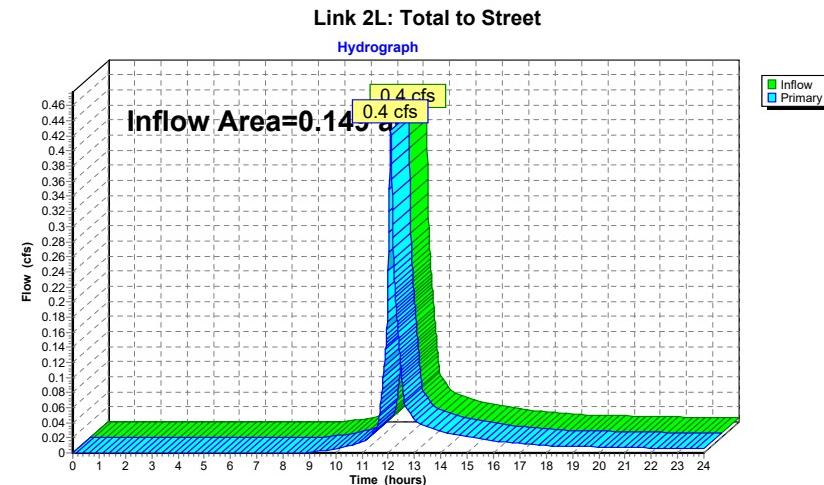
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#### Summary for Link 2L: Total to Street

Inflow Area = 0.149 ac, 7.57% Impervious, Inflow Depth > 2.45" for 10-Year event  
Inflow = 0.4 cfs @ 12.09 hrs, Volume= 0.030 af  
Primary = 0.4 cfs @ 12.09 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: CB-1</b>	Runoff Area=13,149 sf 83.09% Impervious Runoff Depth>5.49" $T_c=6.0 \text{ min}$ CN=94 Runoff=1.8 cfs 0.138 af
<b>Subcatchment 2S: Building Roof</b>	Runoff Area=51,814 sf 100.00% Impervious Runoff Depth>5.96" $T_c=6.0 \text{ min}$ CN=98 Runoff=7.2 cfs 0.590 af
<b>Subcatchment 3S: Courtyard Roofs</b>	Runoff Area=14,820 sf 100.00% Impervious Runoff Depth>5.96" $T_c=6.0 \text{ min}$ CN=98 Runoff=2.1 cfs 0.169 af
<b>Subcatchment 4S: TD-2</b>	Runoff Area=6,330 sf 100.00% Impervious Runoff Depth>5.96" $T_c=6.0 \text{ min}$ CN=98 Runoff=0.9 cfs 0.072 af
<b>Subcatchment 5S: TD-1</b>	Runoff Area=11,872 sf 34.45% Impervious Runoff Depth>4.17" $T_c=6.0 \text{ min}$ CN=82 Runoff=1.3 cfs 0.095 af
<b>Subcatchment 6S: Bypass Towards</b>	Runoff Area=50,395 sf 0.00% Impervious Runoff Depth>3.26" $T_c=0.0 \text{ min}$ CN=73 Runoff=5.4 cfs 0.314 af
<b>Subcatchment 7S: To Street</b>	Runoff Area=6,474 sf 7.57% Impervious Runoff Depth>3.55" $T_c=6.0 \text{ min}$ CN=76 Runoff=0.6 cfs 0.044 af
<b>Pond 1P: Underground Infiltration System-1</b>	Peak Elev=7.56' Storage=10,332 cf Inflow=4.7 cfs 0.379 af Discarded=0.0 cfs 0.050 af Primary=0.5 cfs 0.112 af Outflow=0.5 cfs 0.163 af
<b>Pond 2P: Rooftop Detention</b>	Peak Elev=57.68' Storage=25,720 cf Inflow=7.2 cfs 0.590 af 12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.0 cfs 0.000 af
<b>Pond 3P: Underground Infiltration System-2</b>	Peak Elev=8.72' Storage=453 cf Inflow=1.3 cfs 0.095 af 12.0" Round Culvert n=0.013 L=44.0' S=0.0050 '/' Outflow=1.3 cfs 0.084 af
<b>Link 1L: Total to Wetlands</b>	Inflow=6.2 cfs 0.511 af Primary=6.2 cfs 0.511 af
<b>Link 2L: Total to Street</b>	Inflow=0.6 cfs 0.044 af Primary=0.6 cfs 0.044 af
<b>Total Runoff Area = 3.555 ac Runoff Volume = 1.422 af Average Runoff Depth = 4.80"</b> <b>42.87% Pervious = 1.524 ac 57.13% Impervious = 2.031 ac</b>	

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### Summary for Subcatchment 1S: CB-1

Runoff = 1.8 cfs @ 12.08 hrs, Volume= 0.138 af, Depth> 5.49"

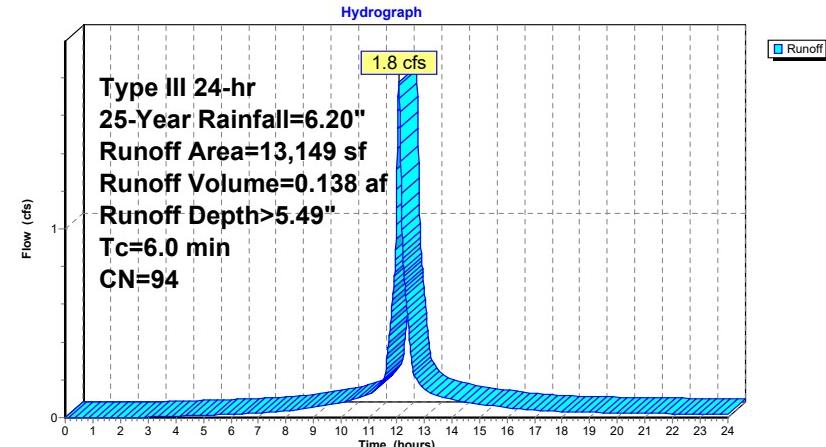
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
10,925	98	Paved parking, HSG C
2,224	74	>75% Grass cover, Good, HSG C
13,149	94	Weighted Average
2,224		16.91% Pervious Area
10,925		83.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 1S: CB-1



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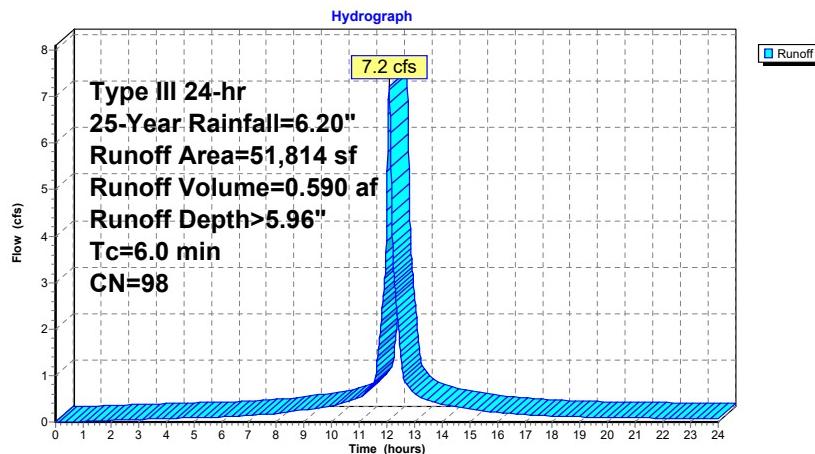
### Summary for Subcatchment 2S: Building Roof

Runoff = 7.2 cfs @ 12.08 hrs, Volume= 0.590 af, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description			
51,814	98	Roofs, HSG C			
51,814		100.00% Impervious Area			
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 2S: Building Roof



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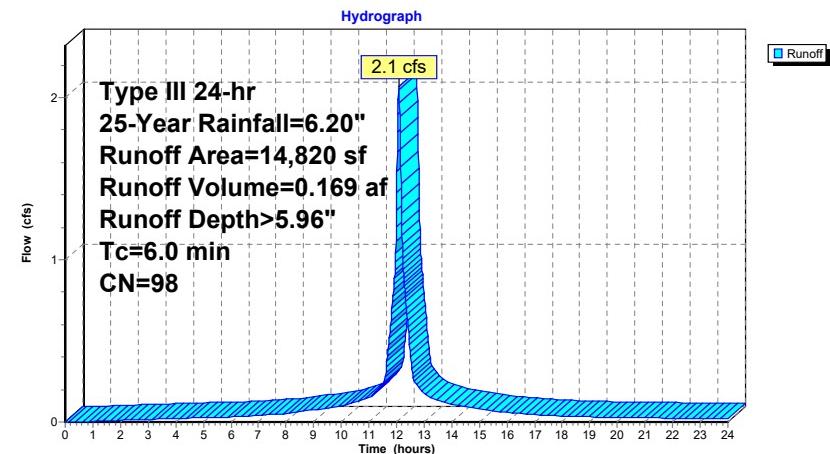
### Summary for Subcatchment 3S: Courtyard Roofs

Runoff = 2.1 cfs @ 12.08 hrs, Volume= 0.169 af, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description			
14,820	98	Roofs, HSG C			
14,820		100.00% Impervious Area			
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 3S: Courtyard Roofs



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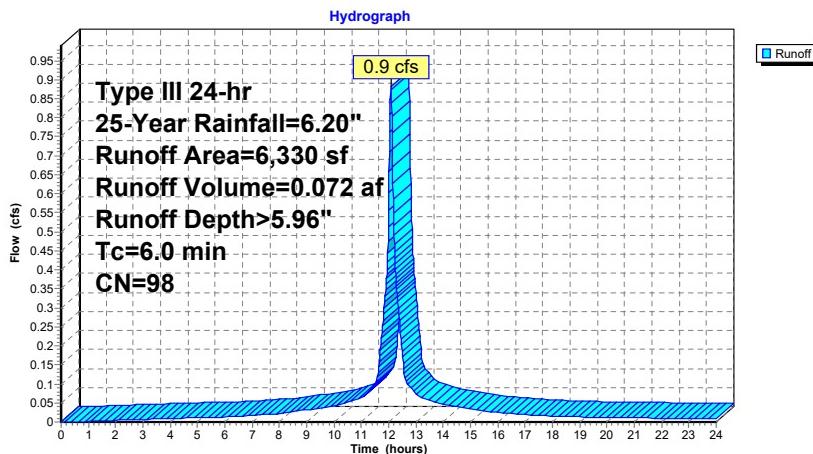
### Summary for Subcatchment 4S: TD-2

Runoff = 0.9 cfs @ 12.08 hrs, Volume= 0.072 af, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description			
6,330	98	Paved parking, HSG C			
6,330		100.00% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 4S: TD-2



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### Summary for Subcatchment 5S: TD-1

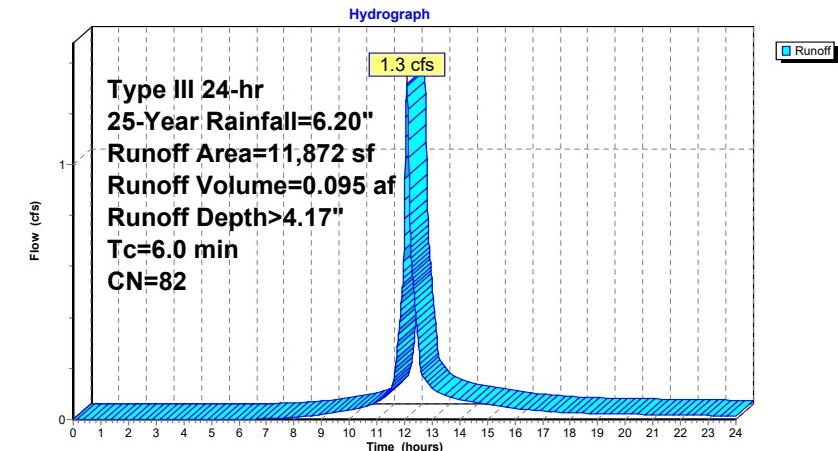
Runoff = 1.3 cfs @ 12.09 hrs, Volume= 0.095 af, Depth> 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
980	98	Roofs, HSG C
3,110	98	Paved parking, HSG C
7,782	74	>75% Grass cover, Good, HSG C
11,872	82	Weighted Average
7,782		65.55% Pervious Area
4,090		34.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 5S: TD-1



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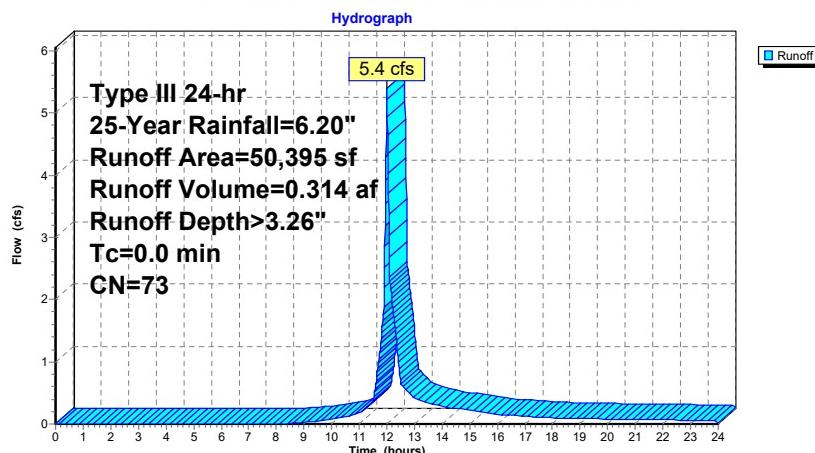
### Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 5.4 cfs @ 12.00 hrs, Volume= 0.314 af, Depth> 3.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
50,395	73	Weighted Average
50,395		100.00% Pervious Area

### Subcatchment 6S: Bypass Towards Wetlands



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### Summary for Subcatchment 7S: To Street

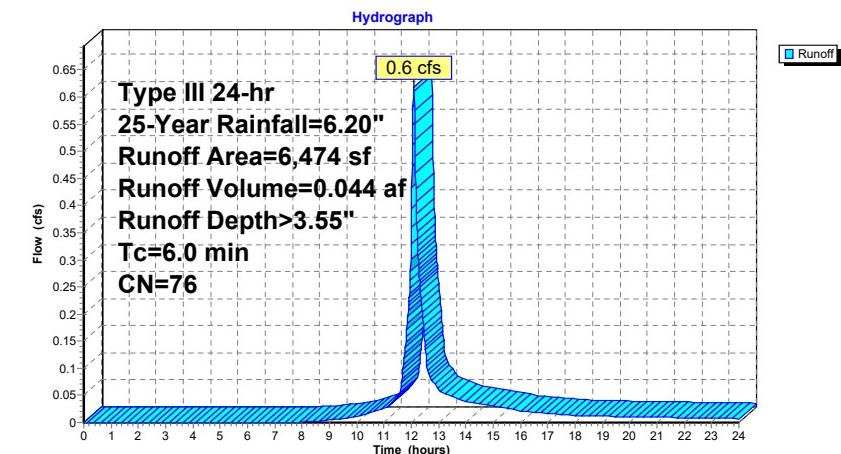
Runoff = 0.6 cfs @ 12.09 hrs, Volume= 0.044 af, Depth> 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
490	98	Paved parking, HSG C
5,984	74	>75% Grass cover, Good, HSG C
6,474	76	Weighted Average
5,984		92.43% Pervious Area
490		7.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
Direct Entry, Min. Tc					

### Subcatchment 7S: To Street



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### Summary for Pond 1P: Underground Infiltration System-1

Inflow Area = 1.977 ac, 97.42% Impervious, Inflow Depth > 2.30" for 25-Year event  
 Inflow = 4.7 cfs @ 12.08 hrs, Volume= 0.379 af  
 Outflow = 0.5 cfs @ 12.79 hrs, Volume= 0.163 af, Atten= 90%, Lag= 42.2 min  
 Discarded = 0.0 cfs @ 5.04 hrs, Volume= 0.050 af  
 Primary = 0.5 cfs @ 12.79 hrs, Volume= 0.112 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 7.56' @ 12.79 hrs Surf.Area= 4,692 sf Storage= 10,332 cf

Plug-Flow detention time= 293.3 min calculated for 0.163 af (43% of inflow)  
 Center-of-Mass det. time= 149.9 min ( 902.4 - 752.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	5.00'	0 cf	<b>38.75'W x 121.08'L x 3.00'H Field A</b> 14,076 cf Overall - 14,076 cf Embedded = 0 cf x 40.0% Voids
#2A	5.00'	10,260 cf	<b>StormTrap ST2 SingleTrap 2-6 x 21 Inside #1</b> Inside= 101.7" W x 30.0"H => 18.82 sf x 15.40'L = 289.8 cf Outside= 101.7" W x 36.0"H => 25.44 sf x 15.40'L = 391.6 cf 3 Rows of 7 Chambers 25.44" x 107.77" Core + 6.66" Border = 38.75" x 121.08" System
#3	5.00'	141 cf	<b>6.00'D x 5.00'H OCS-1-Impervious</b>

10,401 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	7.20'	<b>15.0" Round Culvert</b> L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.20' / 6.55' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

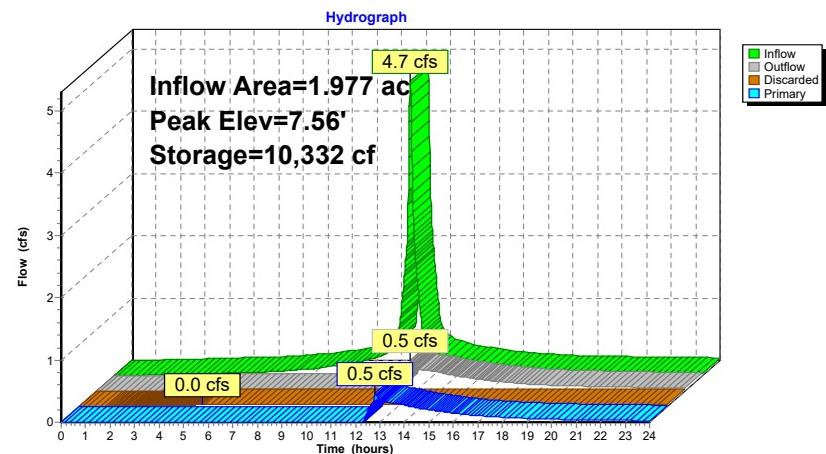
**Discarded OutFlow** Max=0.0 cfs @ 5.04 hrs HW=5.05' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.0 cfs)

**Primary OutFlow** Max=0.5 cfs @ 12.79 hrs HW=7.56' (Free Discharge)  
 ↑2=Culvert (Barrel Controls 0.5 cfs @ 2.34 fps)

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### Pond 1P: Underground Infiltration System-1



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### Summary for Pond 2P: Rooftop Detention

Inflow Area = 1.189 ac, 100.00% Impervious, Inflow Depth > 5.96" for 25-Year event  
Inflow = 7.2 cfs @ 12.08 hrs, Volume= 0.590 af  
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min  
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Peak Elev= 57.68' @ 24.00 hrs Surf.Area= 38,000 sf Storage= 25,720 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	Rooftop Detention (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

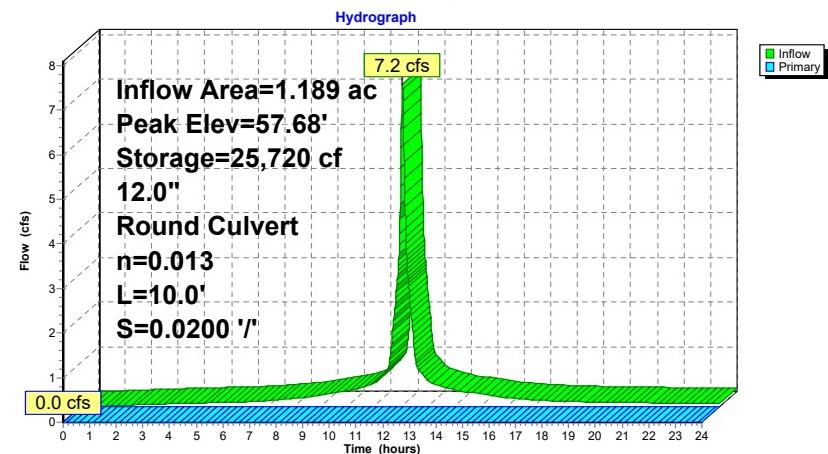
Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	<b>12.0" Round Roof Drain</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 58.00' / 57.80' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=57.00' (Free Discharge)  
↑=Roof Drain (Controls 0.0 cfs)

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### Pond 2P: Rooftop Detention



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### Summary for Pond 3P: Underground Infiltration System-2

Inflow Area = 0.273 ac, 34.45% Impervious, Inflow Depth > 4.17" for 25-Year event  
 Inflow = 1.3 cfs @ 12.09 hrs, Volume= 0.095 af  
 Outflow = 1.3 cfs @ 12.09 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.1 min  
 Primary = 1.3 cfs @ 12.09 hrs, Volume= 0.084 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 8.72' @ 12.09 hrs Surf.Area= 388 sf Storage= 453 cf

Plug-Flow detention time= 75.4 min calculated for 0.084 af (89% of inflow)  
 Center-of-Mass det. time= 24.6 min ( 831.6 - 807.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	3.00'	204 cf	<b>21.50'W x 17.44'L x 1.83'H Field A</b> 687 cf Overall - 177 cf Embedded = 511 cf x 40.0% Voids
#2A	3.00'	177 cf	<b>ADS_StormTech SC-310 +Cap x 12 Inside #1</b> Effective Size= 28.9"W x 16.0'H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0'H x 7.56'L with 0.44' Overlap 6 Rows of 2 Chambers
#3	3.00'	75 cf	<b>4.00'D x 6.00'H OCS</b> 457 cf Total Available Storage

Storage Group A created with Chamber Wizard

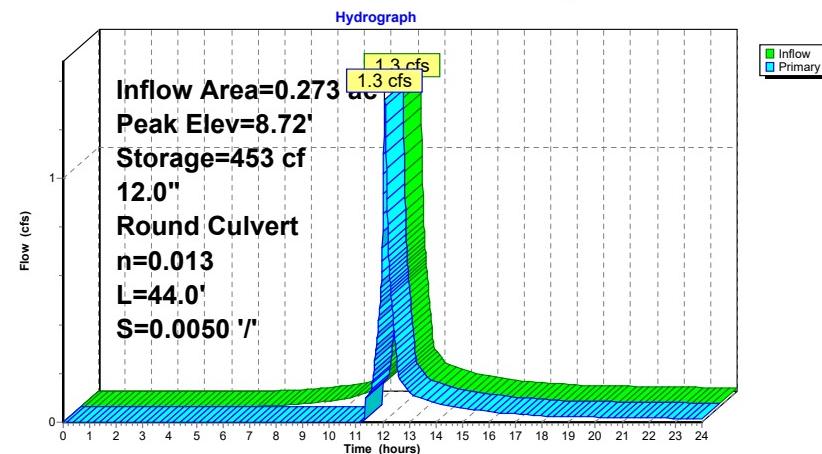
Device	Routing	Invert	Outlet Devices
#1	Primary	8.00'	<b>12.0" Round Culvert</b> L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.78' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.3 cfs @ 12.09 hrs HW=8.72' (Free Discharge)  
 ↑=Culvert (Barrel Controls 1.3 cfs @ 3.04 fps)

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### Pond 3P: Underground Infiltration System-2



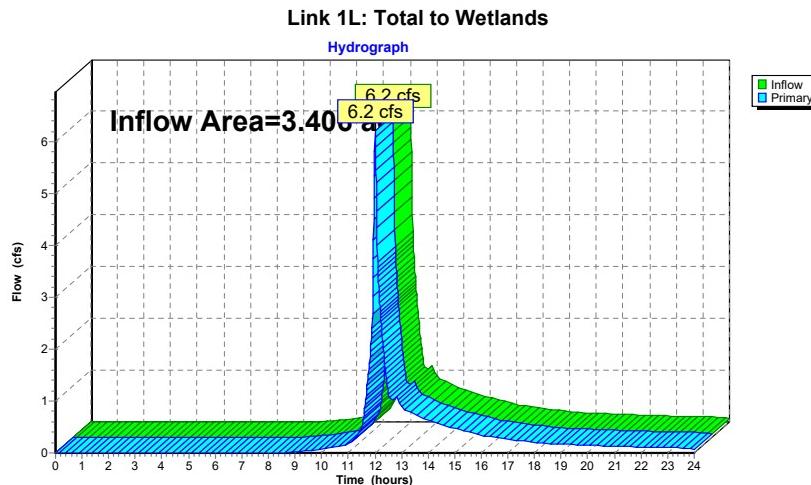
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#### Summary for Link 1L: Total to Wetlands

Inflow Area = 3.406 ac, 59.29% Impervious, Inflow Depth > 1.80" for 25-Year event  
Inflow = 6.2 cfs @ 12.00 hrs, Volume= 0.511 af  
Primary = 6.2 cfs @ 12.00 hrs, Volume= 0.511 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



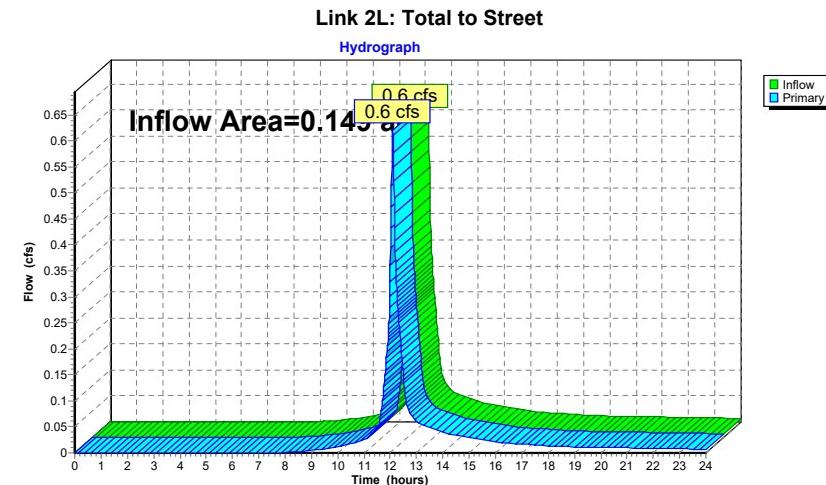
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#### Summary for Link 2L: Total to Street

Inflow Area = 0.149 ac, 7.57% Impervious, Inflow Depth > 3.55" for 25-Year event  
Inflow = 0.6 cfs @ 12.09 hrs, Volume= 0.044 af  
Primary = 0.6 cfs @ 12.09 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: CB-1</b>	Runoff Area=13,149 sf 83.09% Impervious Runoff Depth>6.71" $T_c=6.0 \text{ min}$ CN=94 Runoff=2.2 cfs 0.169 af
<b>Subcatchment 2S: Building Roof</b>	Runoff Area=51,814 sf 100.00% Impervious Runoff Depth>7.19" $T_c=6.0 \text{ min}$ CN=98 Runoff=8.7 cfs 0.712 af
<b>Subcatchment 3S: Courtyard Roofs</b>	Runoff Area=14,820 sf 100.00% Impervious Runoff Depth>7.19" $T_c=6.0 \text{ min}$ CN=98 Runoff=2.5 cfs 0.204 af
<b>Subcatchment 4S: TD-2</b>	Runoff Area=6,330 sf 100.00% Impervious Runoff Depth>7.19" $T_c=6.0 \text{ min}$ CN=98 Runoff=1.1 cfs 0.087 af
<b>Subcatchment 5S: TD-1</b>	Runoff Area=11,872 sf 34.45% Impervious Runoff Depth>5.32" $T_c=6.0 \text{ min}$ CN=82 Runoff=1.7 cfs 0.121 af
<b>Subcatchment 6S: Bypass Towards</b>	Runoff Area=50,395 sf 0.00% Impervious Runoff Depth>4.31" $T_c=0.0 \text{ min}$ CN=73 Runoff=7.2 cfs 0.415 af
<b>Subcatchment 7S: To Street</b>	Runoff Area=6,474 sf 7.57% Impervious Runoff Depth>4.64" $T_c=6.0 \text{ min}$ CN=76 Runoff=0.8 cfs 0.057 af
<b>Pond 1P: Underground Infiltration System-1</b>	Peak Elev=8.28' Storage=10,352 cf Inflow=5.7 cfs 0.460 af Discarded=0.0 cfs 0.051 af Primary=3.1 cfs 0.190 af Outflow=3.2 cfs 0.241 af
<b>Pond 2P: Rooftop Detention</b>	Peak Elev=57.82' Storage=31,022 cf Inflow=8.7 cfs 0.712 af 12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.0 cfs 0.000 af
<b>Pond 3P: Underground Infiltration System-2</b>	Peak Elev=8.84' Storage=454 cf Inflow=1.7 cfs 0.121 af 12.0" Round Culvert n=0.013 L=44.0' S=0.0050 '/' Outflow=1.7 cfs 0.111 af
<b>Link 1L: Total to Wetlands</b>	Inflow=8.2 cfs 0.716 af Primary=8.2 cfs 0.716 af
<b>Link 2L: Total to Street</b>	Inflow=0.8 cfs 0.057 af Primary=0.8 cfs 0.057 af
<b>Total Runoff Area = 3.555 ac Runoff Volume = 1.765 af Average Runoff Depth = 5.96"</b> <b>42.87% Pervious = 1.524 ac 57.13% Impervious = 2.031 ac</b>	

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### Summary for Subcatchment 1S: CB-1

Runoff = 2.2 cfs @ 12.08 hrs, Volume= 0.169 af, Depth> 6.71"

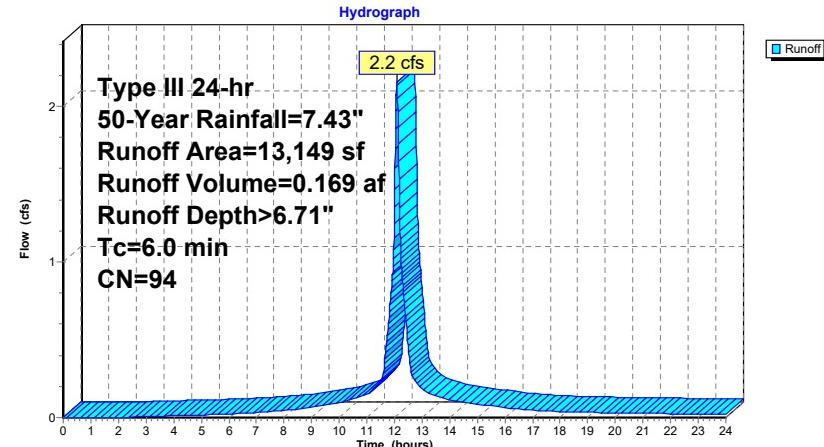
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
10,925	98	Paved parking, HSG C
2,224	74	>75% Grass cover, Good, HSG C
13,149	94	Weighted Average
2,224		16.91% Pervious Area
10,925		83.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 1S: CB-1



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### Summary for Subcatchment 2S: Building Roof

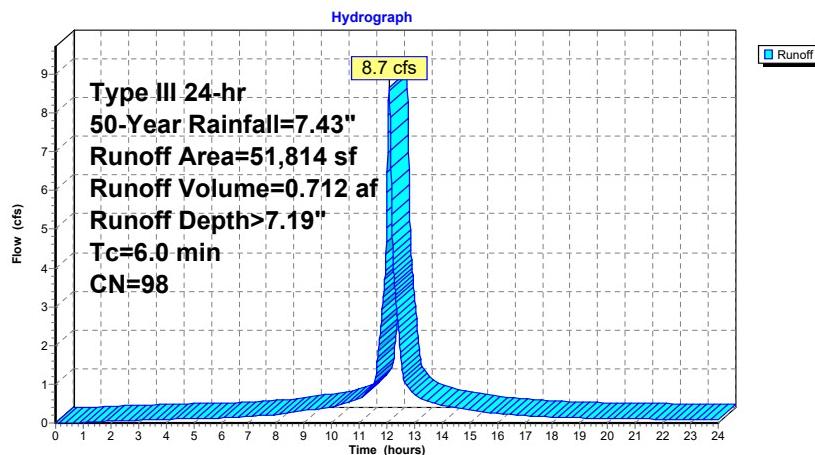
Runoff = 8.7 cfs @ 12.08 hrs, Volume= 0.712 af, Depth> 7.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
51,814	98	Roofs, HSG C
51,814		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 2S: Building Roof



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### Summary for Subcatchment 3S: Courtyard Roofs

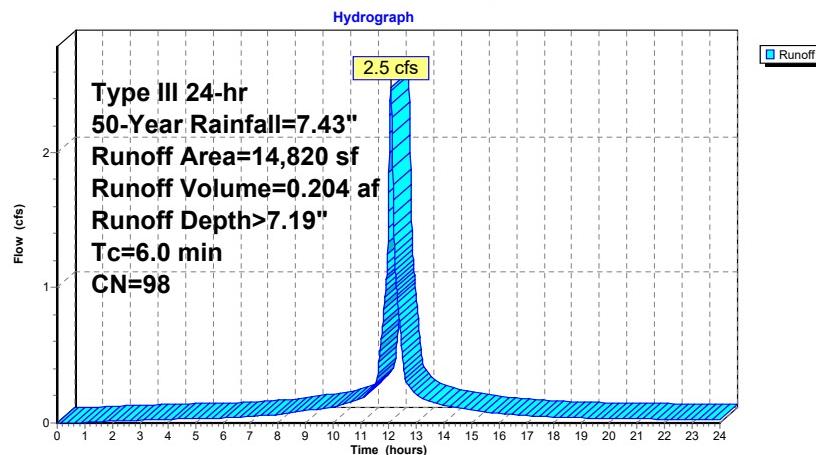
Runoff = 2.5 cfs @ 12.08 hrs, Volume= 0.204 af, Depth> 7.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
14,820	98	Roofs, HSG C
14,820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 3S: Courtyard Roofs



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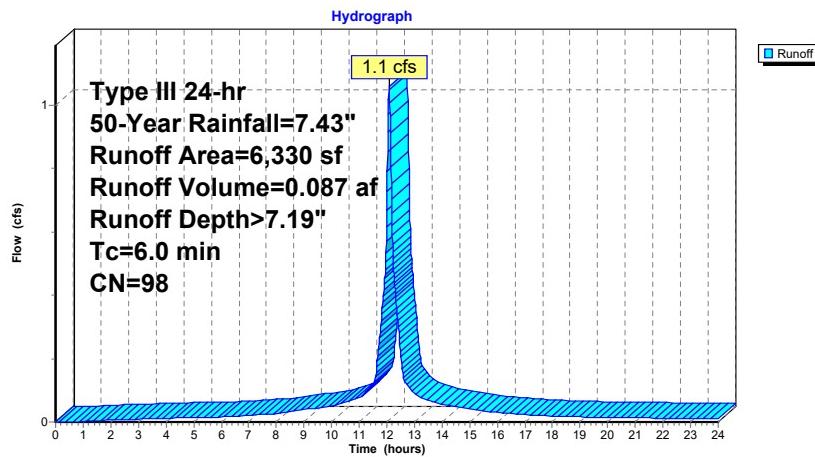
### Summary for Subcatchment 4S: TD-2

Runoff = 1.1 cfs @ 12.08 hrs, Volume= 0.087 af, Depth> 7.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description			
6,330	98	Paved parking, HSG C			
6,330		100.00% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 4S: TD-2



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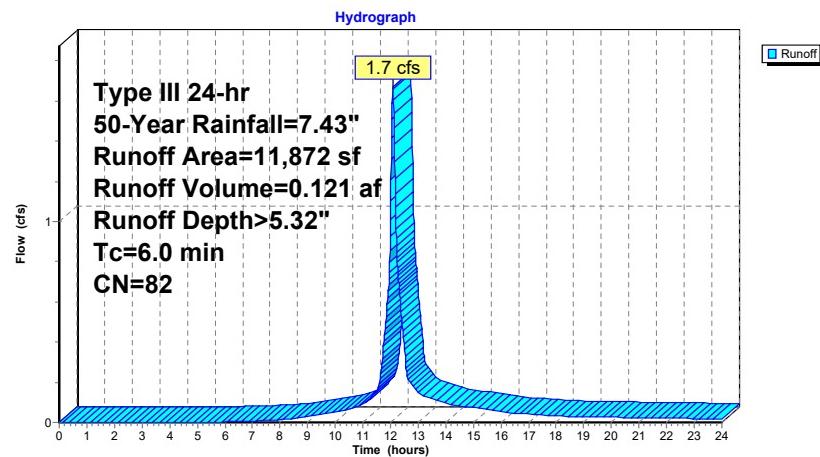
### Summary for Subcatchment 5S: TD-1

Runoff = 1.7 cfs @ 12.09 hrs, Volume= 0.121 af, Depth> 5.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description			
980	98	Roofs, HSG C			
3,110	98	Paved parking, HSG C			
7,782	74	>75% Grass cover, Good, HSG C			
11,872	82	Weighted Average			
7,782		65.55% Pervious Area			
4,090		34.45% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 5S: TD-1



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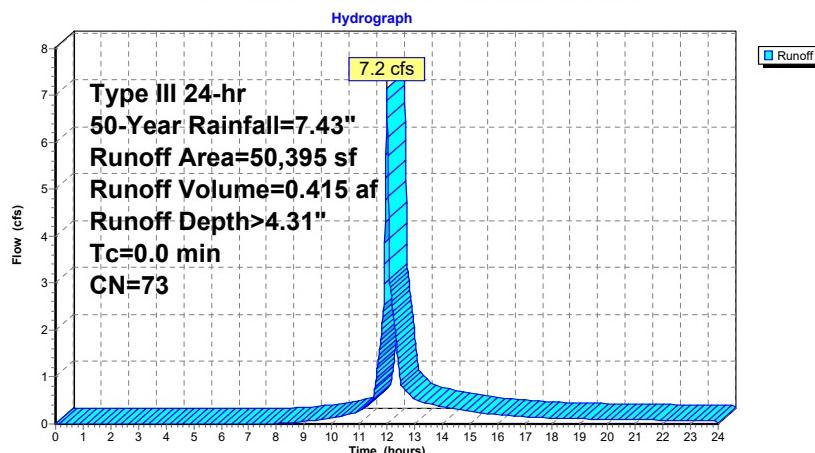
### Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 7.2 cfs @ 12.00 hrs, Volume= 0.415 af, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
50,395	73	Weighted Average
50,395		100.00% Pervious Area

### Subcatchment 6S: Bypass Towards Wetlands



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### Summary for Subcatchment 7S: To Street

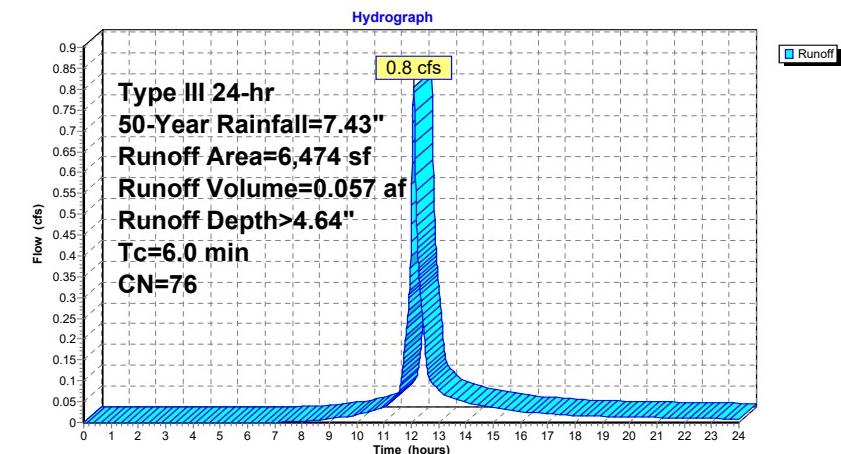
Runoff = 0.8 cfs @ 12.09 hrs, Volume= 0.057 af, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
490	98	Paved parking, HSG C
5,984	74	>75% Grass cover, Good, HSG C
6,474	76	Weighted Average
5,984		92.43% Pervious Area
490		7.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 7S: To Street



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### Summary for Pond 1P: Underground Infiltration System-1

Inflow Area = 1.977 ac, 97.42% Impervious, Inflow Depth > 2.79" for 50-Year event  
 Inflow = 5.7 cfs @ 12.08 hrs, Volume= 0.460 af  
 Outflow = 3.2 cfs @ 12.22 hrs, Volume= 0.241 af, Atten= 44%, Lag= 8.5 min  
 Discarded = 0.0 cfs @ 4.23 hrs, Volume= 0.051 af  
 Primary = 3.1 cfs @ 12.22 hrs, Volume= 0.190 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 8.28' @ 12.22 hrs Surf.Area= 4,692 sf Storage= 10,352 cf

Plug-Flow detention time= 243.1 min calculated for 0.241 af (53% of inflow)  
 Center-of-Mass det. time= 119.7 min ( 869.0 - 749.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	5.00'	0 cf	<b>38.75'W x 121.08'L x 3.00'H Field A</b> 14,076 cf Overall - 14,076 cf Embedded = 0 cf x 40.0% Voids
#2A	5.00'	10,260 cf	<b>StormTrap ST2 SingleTrap 2-6 x 21 Inside #1</b> Inside= 101.7" W x 30.0"H => 18.82 sf x 15.40'L = 289.8 cf Outside= 101.7" W x 36.0"H => 25.44 sf x 15.40'L = 391.6 cf 3 Rows of 7 Chambers
#3	5.00'	141 cf	<b>6.00'D x 5.00'H OCS-1-Impervious</b> 25.44" x 107.77" Core + 6.66" Border = 38.75" x 121.08" System
		10,401 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	<b>0.270 in/hr Exfiltration over Surface area</b> <b>15.0" Round Culvert</b>
#2	Primary	7.20'	L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.20' / 6.55' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

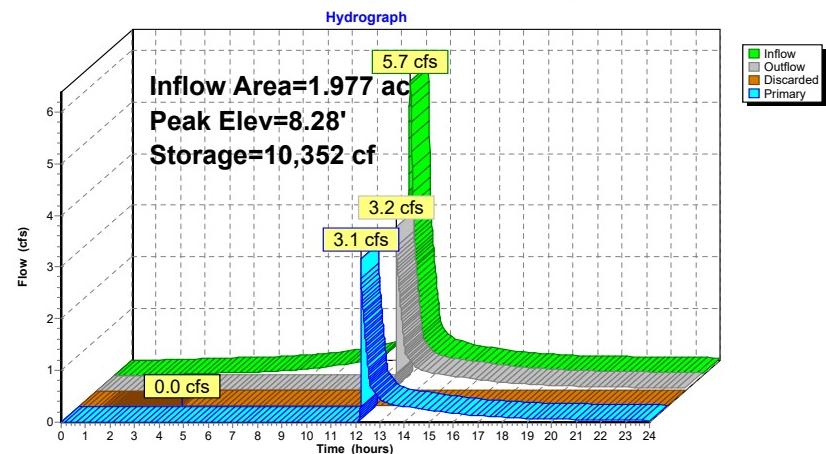
**Discarded OutFlow** Max=0.0 cfs @ 4.23 hrs HW=5.05' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.0 cfs)

**Primary OutFlow** Max=2.8 cfs @ 12.22 hrs HW=8.19' (Free Discharge)  
 ↑2=Culvert (Barrel Controls 2.8 cfs @ 3.73 fps)

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### Pond 1P: Underground Infiltration System-1



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### Summary for Pond 2P: Rooftop Detention

Inflow Area = 1.189 ac, 100.00% Impervious, Inflow Depth > 7.19" for 50-Year event  
Inflow = 8.7 cfs @ 12.08 hrs, Volume= 0.712 af  
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min  
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Peak Elev= 57.82' @ 24.00 hrs Surf.Area= 38,000 sf Storage= 31,022 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	Rooftop Detention (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	12.0" Round Roof Drain L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 58.00' / 57.80' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

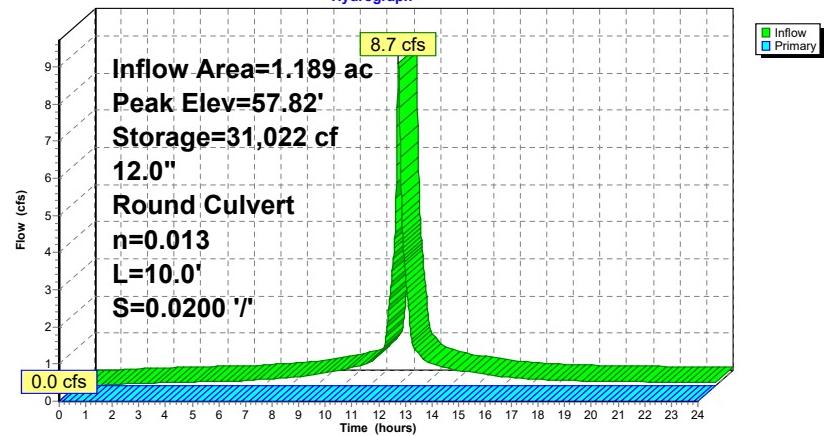
Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=57.00' (Free Discharge)  
↑=Roof Drain (Controls 0.0 cfs)

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### Pond 2P: Rooftop Detention

Hydrograph



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### Summary for Pond 3P: Underground Infiltration System-2

Inflow Area = 0.273 ac, 34.45% Impervious, Inflow Depth > 5.32" for 50-Year event  
 Inflow = 1.7 cfs @ 12.09 hrs, Volume= 0.121 af  
 Outflow = 1.7 cfs @ 12.09 hrs, Volume= 0.111 af, Atten= 0%, Lag= 0.1 min  
 Primary = 1.7 cfs @ 12.09 hrs, Volume= 0.111 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 8.84' @ 12.09 hrs Surf.Area= 388 sf Storage= 454 cf

Plug-Flow detention time= 64.4 min calculated for 0.110 af (92% of inflow)  
 Center-of-Mass det. time= 22.0 min ( 822.2 - 800.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	3.00'	204 cf	<b>21.50'W x 17.44'L x 1.83'H Field A</b> 687 cf Overall - 177 cf Embedded = 511 cf x 40.0% Voids
#2A	3.00'	177 cf	<b>ADS_StormTech SC-310 +Cap x 12 Inside #1</b> Effective Size= 28.9"W x 16.0'H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0'H x 7.56'L with 0.44' Overlap 6 Rows of 2 Chambers
#3	3.00'	75 cf	<b>4.00'D x 6.00'H OCS</b> 457 cf Total Available Storage

Storage Group A created with Chamber Wizard

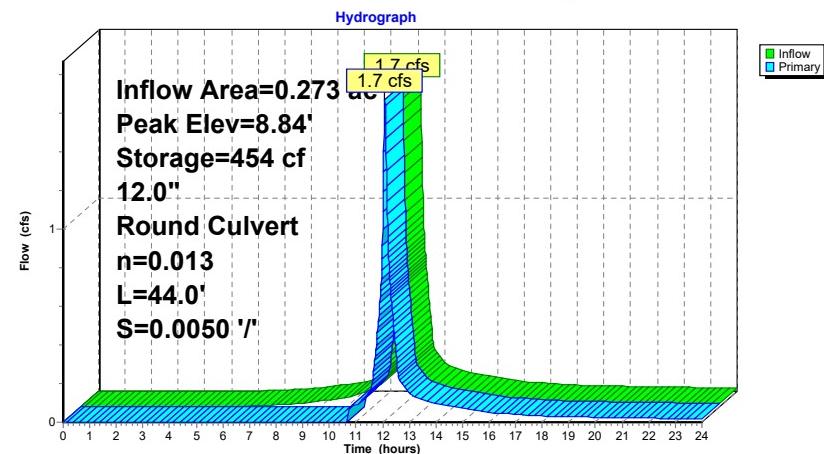
Device	Routing	Invert	Outlet Devices
#1	Primary	8.00'	<b>12.0" Round Culvert</b> L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.78' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.7 cfs @ 12.09 hrs HW=8.83' (Free Discharge)  
 ↑=Culvert (Barrel Controls 1.7 cfs @ 3.22 fps)

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### Pond 3P: Underground Infiltration System-2



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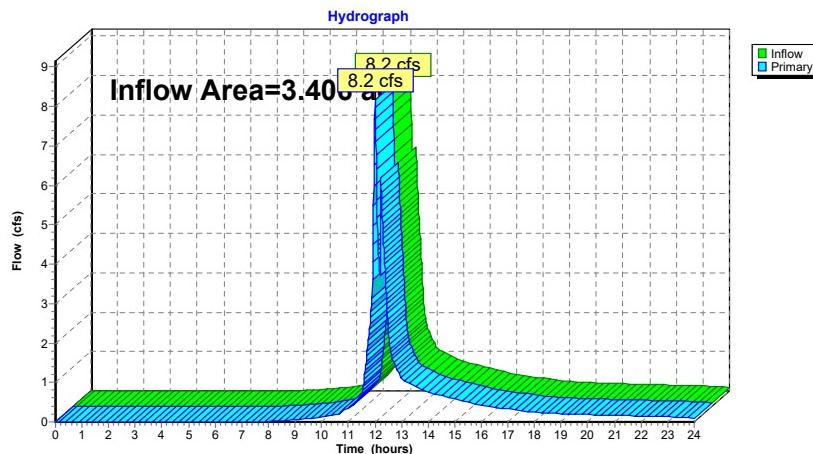
Thorndike Place Post-Development  
Type III 24-hr 50-Year Rainfall=7.43"  
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#### Summary for Link 1L: Total to Wetlands

Inflow Area = 3.406 ac, 59.29% Impervious, Inflow Depth > 2.52" for 50-Year event  
Inflow = 8.2 cfs @ 12.00 hrs, Volume= 0.716 af  
Primary = 8.2 cfs @ 12.00 hrs, Volume= 0.716 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

#### Link 1L: Total to Wetlands



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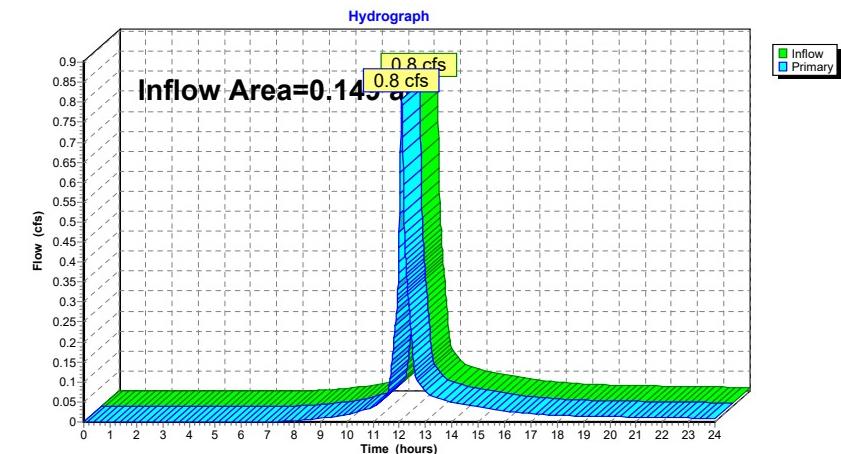
Thorndike Place Post-Development  
Type III 24-hr 50-Year Rainfall=7.43"  
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#### Summary for Link 2L: Total to Street

Inflow Area = 0.149 ac, 7.57% Impervious, Inflow Depth > 4.64" for 50-Year event  
Inflow = 0.8 cfs @ 12.09 hrs, Volume= 0.057 af  
Primary = 0.8 cfs @ 12.09 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

#### Link 2L: Total to Street



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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: CB-1</b>	Runoff Area=13,149 sf 83.09% Impervious Runoff Depth>8.16" $T_c=6.0 \text{ min}$ CN=94 Runoff=2.6 cfs 0.205 af
<b>Subcatchment 2S: Building Roof</b>	Runoff Area=51,814 sf 100.00% Impervious Runoff Depth>8.64" $T_c=6.0 \text{ min}$ CN=98 Runoff=10.4 cfs 0.857 af
<b>Subcatchment 3S: Courtyard Roofs</b>	Runoff Area=14,820 sf 100.00% Impervious Runoff Depth>8.64" $T_c=6.0 \text{ min}$ CN=98 Runoff=3.0 cfs 0.245 af
<b>Subcatchment 4S: TD-2</b>	Runoff Area=6,330 sf 100.00% Impervious Runoff Depth>8.64" $T_c=6.0 \text{ min}$ CN=98 Runoff=1.3 cfs 0.105 af
<b>Subcatchment 5S: TD-1</b>	Runoff Area=11,872 sf 34.45% Impervious Runoff Depth>6.70" $T_c=6.0 \text{ min}$ CN=82 Runoff=2.1 cfs 0.152 af
<b>Subcatchment 6S: Bypass Towards</b>	Runoff Area=50,395 sf 0.00% Impervious Runoff Depth>5.61" $T_c=0.0 \text{ min}$ CN=73 Runoff=9.3 cfs 0.540 af
<b>Subcatchment 7S: To Street</b>	Runoff Area=6,474 sf 7.57% Impervious Runoff Depth>5.97" $T_c=6.0 \text{ min}$ CN=76 Runoff=1.0 cfs 0.074 af
<b>Pond 1P: Underground Infiltration System-1</b>	Peak Elev=9.88' Storage=10,398 cf Inflow=6.8 cfs 0.555 af Discarded=0.0 cfs 0.053 af Primary=6.6 cfs 0.284 af Outflow=6.6 cfs 0.336 af
<b>Pond 2P: Rooftop Detention</b>	Peak Elev=57.98' Storage=37,318 cf Inflow=10.4 cfs 0.857 af 12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.0 cfs 0.000 af
<b>Pond 3P: Underground Infiltration System-2</b>	Peak Elev=8.97' Storage=456 cf Inflow=2.1 cfs 0.152 af 12.0" Round Culvert n=0.013 L=44.0' S=0.0050 '/' Outflow=2.1 cfs 0.142 af
<b>Link 1L: Total to Wetlands</b>	Inflow=12.6 cfs 0.966 af Primary=12.6 cfs 0.966 af
<b>Link 2L: Total to Street</b>	Inflow=1.0 cfs 0.074 af Primary=1.0 cfs 0.074 af
<b>Total Runoff Area = 3.555 ac Runoff Volume = 2.178 af Average Runoff Depth = 7.35"</b> <b>42.87% Pervious = 1.524 ac 57.13% Impervious = 2.031 ac</b>	

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### Summary for Subcatchment 1S: CB-1

Runoff = 2.6 cfs @ 12.08 hrs, Volume= 0.205 af, Depth> 8.16"

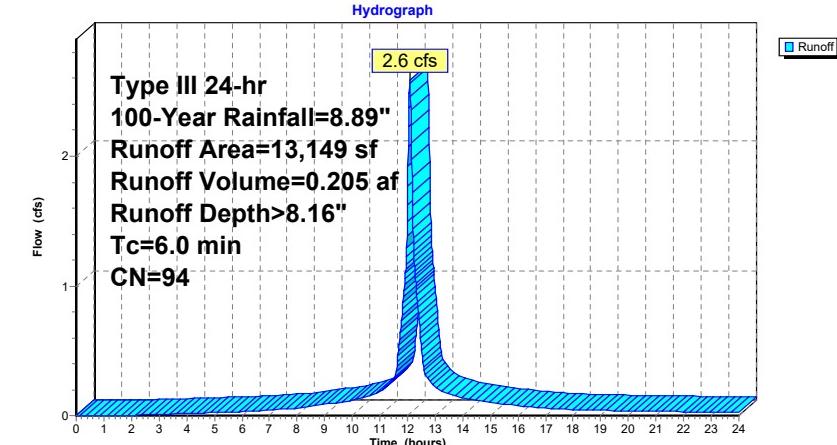
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
10,925	98	Paved parking, HSG C
2,224	74	>75% Grass cover, Good, HSG C
13,149	94	Weighted Average
2,224		16.91% Pervious Area
10,925		83.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 1S: CB-1



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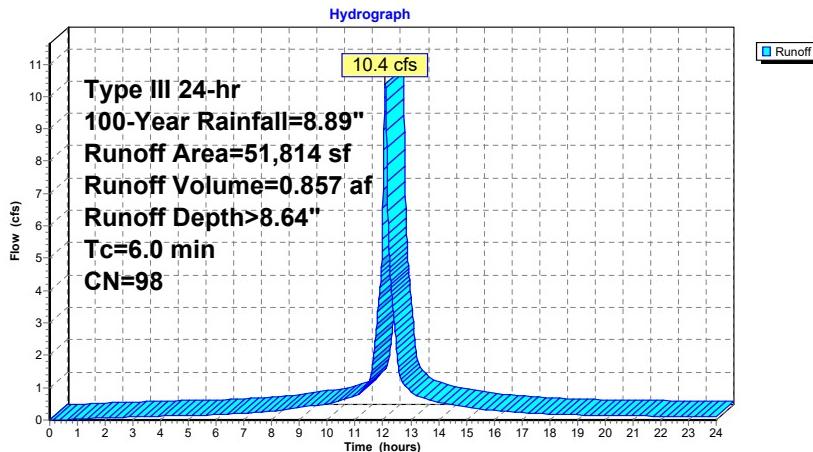
### Summary for Subcatchment 2S: Building Roof

Runoff = 10.4 cfs @ 12.08 hrs, Volume= 0.857 af, Depth> 8.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description			
51,814	98	Roofs, HSG C			
51,814		100.00% Impervious Area			
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 2S: Building Roof



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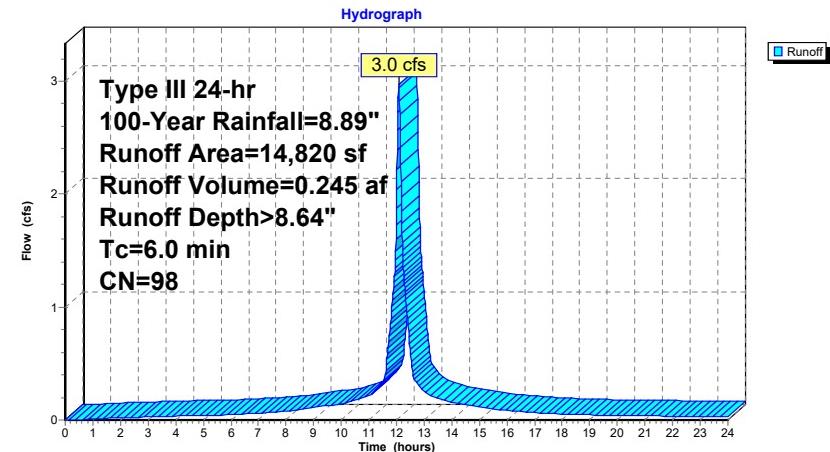
### Summary for Subcatchment 3S: Courtyard Roofs

Runoff = 3.0 cfs @ 12.08 hrs, Volume= 0.245 af, Depth> 8.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description			
14,820	98	Roofs, HSG C			
14,820		100.00% Impervious Area			
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 3S: Courtyard Roofs



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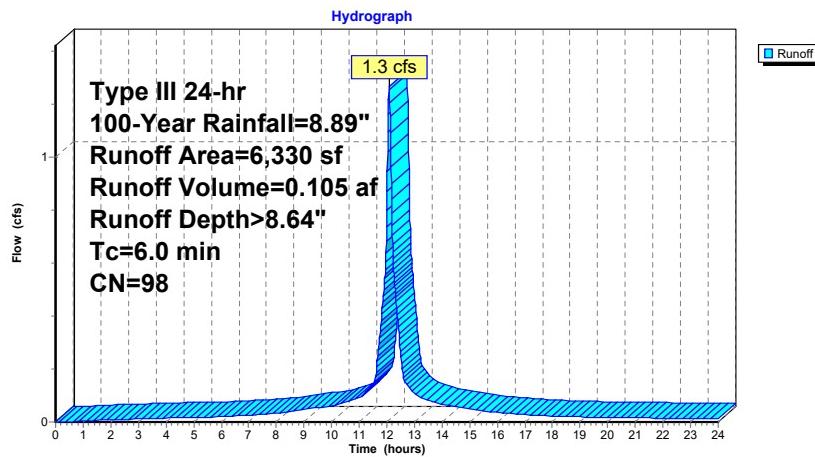
### Summary for Subcatchment 4S: TD-2

Runoff = 1.3 cfs @ 12.08 hrs, Volume= 0.105 af, Depth> 8.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description			
6,330	98	Paved parking, HSG C			
6,330		100.00% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 4S: TD-2



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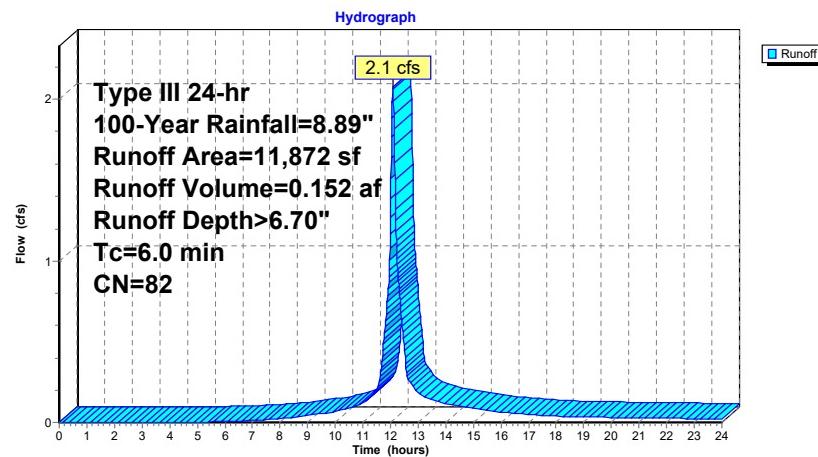
### Summary for Subcatchment 5S: TD-1

Runoff = 2.1 cfs @ 12.09 hrs, Volume= 0.152 af, Depth> 6.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description			
980	98	Roofs, HSG C			
3,110	98	Paved parking, HSG C			
7,782	74	>75% Grass cover, Good, HSG C			
11,872	82	Weighted Average			
7,782		65.55% Pervious Area			
4,090		34.45% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 5S: TD-1



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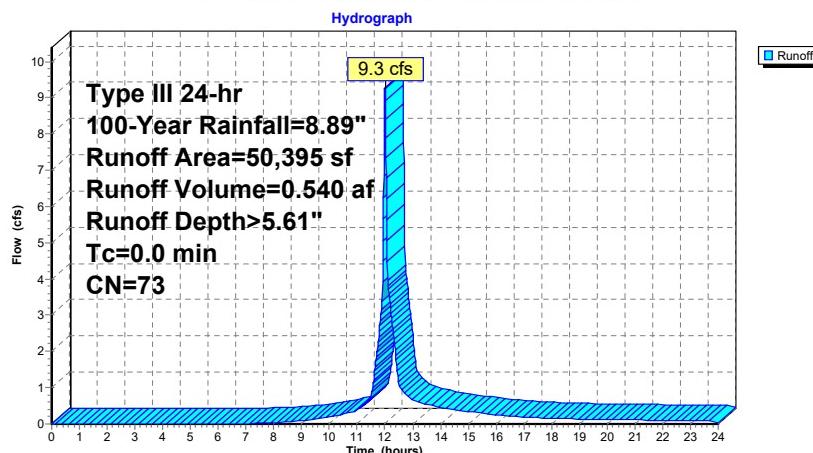
### Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 9.3 cfs @ 12.00 hrs, Volume= 0.540 af, Depth> 5.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
50,395	73	Weighted Average
50,395		100.00% Pervious Area

### Subcatchment 6S: Bypass Towards Wetlands



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### Summary for Subcatchment 7S: To Street

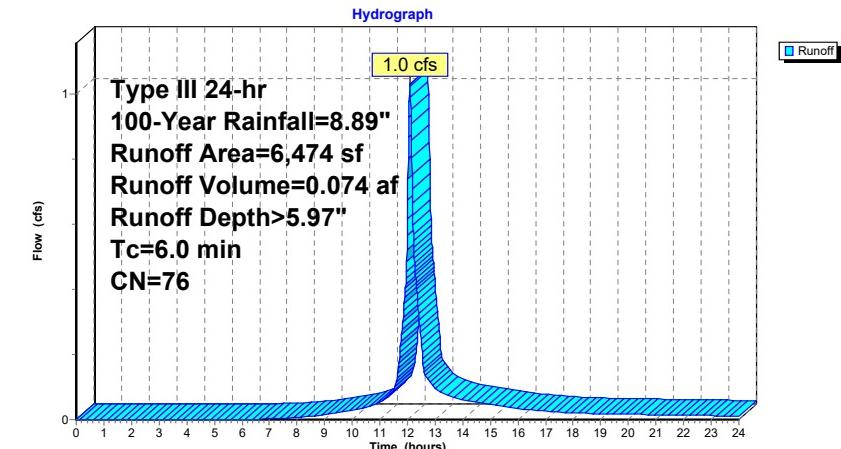
Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.074 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
490	98	Paved parking, HSG C
5,984	74	>75% Grass cover, Good, HSG C
6,474	76	Weighted Average
5,984		92.43% Pervious Area
490		7.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Tc

### Subcatchment 7S: To Street



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### Summary for Pond 1P: Underground Infiltration System-1

Inflow Area = 1.977 ac, 97.42% Impervious, Inflow Depth > 3.37" for 100-Year event  
 Inflow = 6.8 cfs @ 12.08 hrs, Volume= 0.555 af  
 Outflow = 6.6 cfs @ 12.10 hrs, Volume= 0.336 af, Atten= 3%, Lag= 1.0 min  
 Discarded = 0.0 cfs @ 3.54 hrs, Volume= 0.053 af  
 Primary = 6.6 cfs @ 12.10 hrs, Volume= 0.284 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 9.88' @ 12.10 hrs Surf.Area= 4,692 sf Storage= 10,398 cf

Plug-Flow detention time= 211.4 min calculated for 0.336 af (61% of inflow)  
 Center-of-Mass det. time= 101.5 min (847.9 - 746.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	5.00'	0 cf	<b>38.75'W x 121.08'L x 3.00'H Field A</b> 14,076 cf Overall - 14,076 cf Embedded = 0 cf x 40.0% Voids
#2A	5.00'	10,260 cf	<b>StormTrap ST2 SingleTrap 2-6 x 21 Inside #1</b> Inside= 101.7" W x 30.0"H => 18.82 sf x 15.40'L = 289.8 cf Outside= 101.7" W x 36.0"H => 25.44 sf x 15.40'L = 391.6 cf 3 Rows of 7 Chambers
#3	5.00'	141 cf	<b>6.00'D x 5.00'H OCS-1-Impermeable</b> 25.44" x 107.77" Core + 6.66" Border = 38.75" x 121.08" System
		10,401 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	7.20'	<b>15.0" Round Culvert</b> L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.20' / 6.55' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

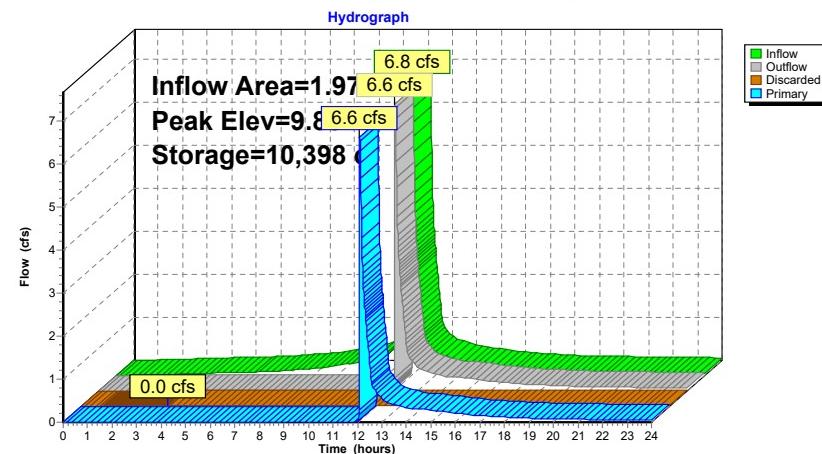
**Discarded OutFlow** Max=0.0 cfs @ 3.54 hrs HW=5.05' (Free Discharge)  
 ↑—1=Exfiltration (Exfiltration Controls 0.0 cfs)

**Primary OutFlow** Max=6.6 cfs @ 12.10 hrs HW=9.85' (Free Discharge)  
 ↑—2=Culvert (Barrel Controls 6.6 cfs @ 5.39 fps)

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### Pond 1P: Underground Infiltration System-1



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### Summary for Pond 2P: Rooftop Detention

Inflow Area = 1.189 ac, 100.00% Impervious, Inflow Depth > 8.64" for 100-Year event  
 Inflow = 10.4 cfs @ 12.08 hrs, Volume= 0.857 af  
 Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min  
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
 Peak Elev= 57.98' @ 24.00 hrs Surf.Area= 38,000 sf Storage= 37,318 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	Rooftop Detention (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

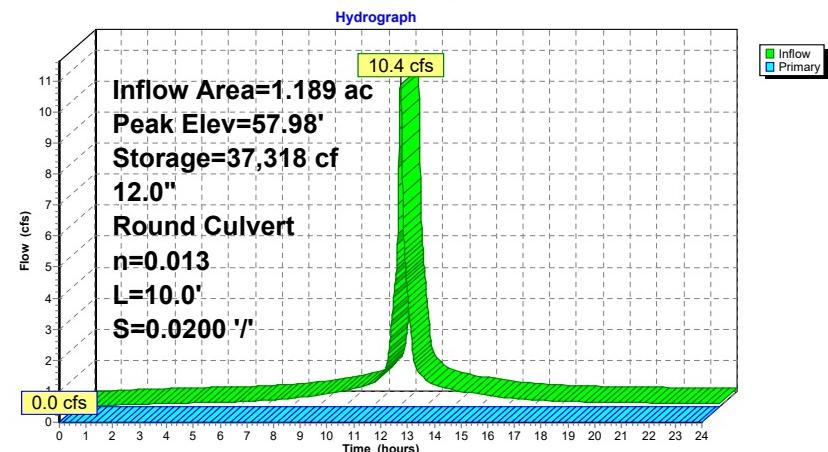
Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	12.0" Round Roof Drain L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 58.00' / 57.80' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=57.00' (Free Discharge)  
 ↑=Roof Drain (Controls 0.0 cfs)

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### Pond 2P: Rooftop Detention



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### Summary for Pond 3P: Underground Infiltration System-2

Inflow Area = 0.273 ac, 34.45% Impervious, Inflow Depth > 6.70" for 100-Year event  
 Inflow = 2.1 cfs @ 12.09 hrs, Volume= 0.152 af  
 Outflow = 2.1 cfs @ 12.09 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.1 min  
 Primary = 2.1 cfs @ 12.09 hrs, Volume= 0.142 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 8.97' @ 12.09 hrs Surf.Area= 388 sf Storage= 456 cf

Plug-Flow detention time= 55.3 min calculated for 0.142 af (93% of inflow)  
 Center-of-Mass det. time= 19.8 min (813.5 - 793.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	3.00'	204 cf	<b>21.50'W x 17.44'L x 1.83'H Field A</b> 687 cf Overall - 177 cf Embedded = 511 cf x 40.0% Voids
#2A	3.00'	177 cf	<b>ADS_StormTech SC-310 +Cap x 12 Inside #1</b> Effective Size= 28.9"W x 16.0'H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0'H x 7.56'L with 0.44' Overlap 6 Rows of 2 Chambers
#3	3.00'	75 cf	<b>4.00'D x 6.00'H OCS</b> 457 cf Total Available Storage

Storage Group A created with Chamber Wizard

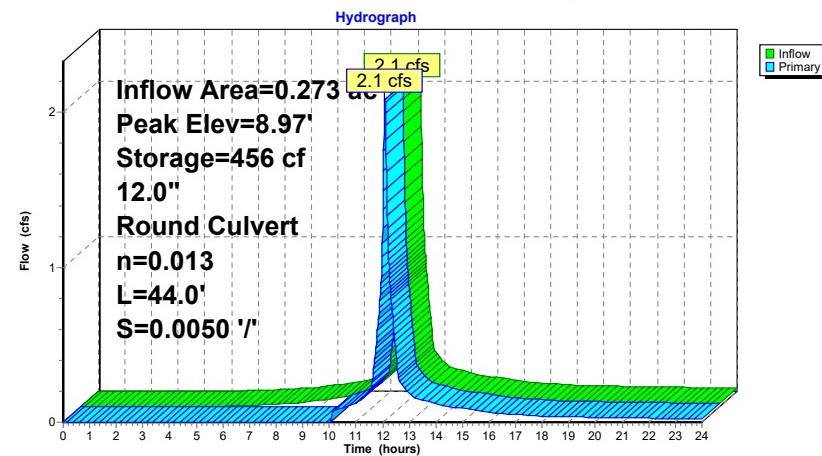
Device	Routing	Invert	Outlet Devices
#1	Primary	8.00'	<b>12.0" Round Culvert</b> L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.78' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.1 cfs @ 12.09 hrs HW=8.97' (Free Discharge)  
 ↑=Culvert (Barrel Controls 2.1 cfs @ 3.39 fps)

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### Pond 3P: Underground Infiltration System-2



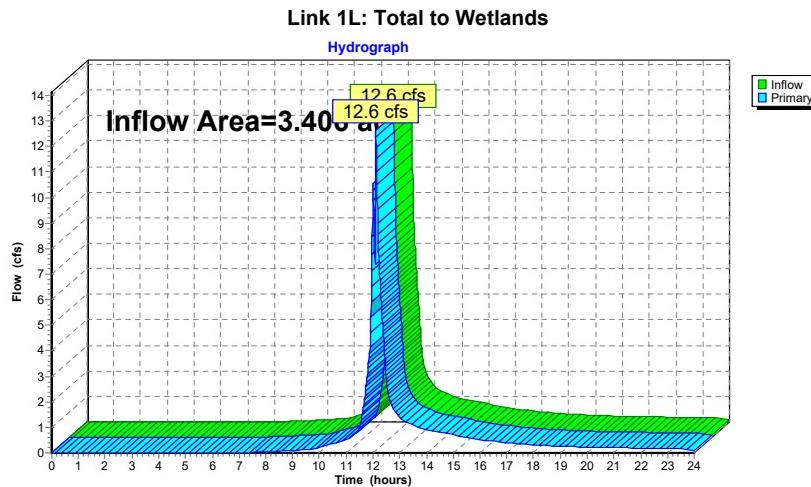
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#### Summary for Link 1L: Total to Wetlands

Inflow Area = 3.406 ac, 59.29% Impervious, Inflow Depth > 3.40" for 100-Year event  
Inflow = 12.6 cfs @ 12.10 hrs, Volume= 0.966 af  
Primary = 12.6 cfs @ 12.10 hrs, Volume= 0.966 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



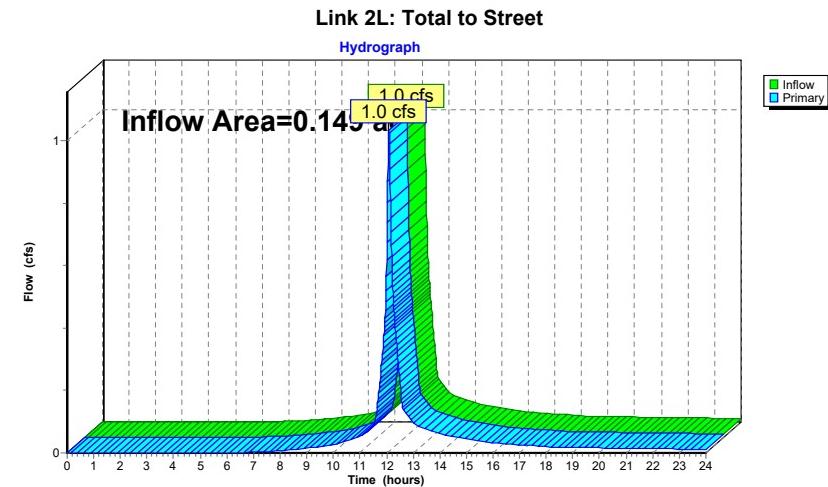
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#### Summary for Link 2L: Total to Street

Inflow Area = 0.149 ac, 7.57% Impervious, Inflow Depth > 5.97" for 100-Year event  
Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.074 af  
Primary = 1.0 cfs @ 12.09 hrs, Volume= 0.074 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



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Thorndike Place

Arlington, MA

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## **SECTION 6.0**

### **ADDITIONAL DRAINAGE CALCULATIONS**

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## **6.01 TSS REMOVAL CALCULATIONS**

# TSS Removal Calculation Worksheet

Location: Thorndike Place, Arlington, MA

Project: 23407.00



Prepared By: D. Rinaldi

Date: 11/02/20

## AREA 1 - CB-1

**Total Impervious Area, Acres= 0.251**

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Deep Sump and Hooded Catchbasins	0.25	1.00	0.25	0.75
Hydrodynamic Separator	0.7	0.75	0.53	0.23
Infiltration Basin	0.8	0.23	0.18	0.05

TSS Removal =

## AREA 2 - TD-1

**Total Impervious Area, Acres= 0.094**

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Hydrodynamic Separator	0.7	1.00	0.70	0.30

TSS Removal =

**AREA 3 - TD-2****Total Impervious Area, Acres= 0.145**

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Hydrodynamic Separator	0.7	1.00	0.70	0.30
Infiltration Basin	0.8	0.30	0.24	0.06

TSS Removal = **AREA 4 - Bypass to Street****Total Impervious Area, Acres= 0.011**

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
		1.00		

TSS Removal = **Weighted Annual Average TSS Removal Rate**

[TSS Removal-1 (Area-1) + TSS Removal-2 (Area-2)+ ....] / [Area-1 + Area-2 + ...] = 0.88

**Project Site TSS Removal =**

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Thorndike Place

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## **6.02 GROUNDWATER RECHARGE VOLUME CALCULATIONS**

Required Recharge Volume

Rv = F x Impervious Area

Where:

Rv = Recharge Volume

F=Target Depth Factor associated with each Hydrologic Soil Group

(F=0.25-inch for Soil Type C)

Impervious Area = Proposed Pavement and Rooftop area on-site

$$Rv = \left( \frac{0.25in}{12} \right) (88,469sft) =$$

Rv = 1,844 cf (required recharge volume)

As not all impervious surfaces are directed to an infiltration BMP, an adjusted Required Volume must be provided. The adjusted Required Volume (Rva) is calculated as:

$$Rva = \frac{\text{Total Imp.Area}}{\text{Imp.Area to BMP}} (Rv) =$$

$$Rva = \left( \frac{88,469sft}{83,889sft} \right) (1,844cf) =$$

$$Rva = 1,945 cf$$

Storage Provided

- Underground Infiltration System-1 = 9,084 cubic feet provided.  
Refer to the HydroCAD calculations provided for more information.

**2340700-PR**

Prepared by BSC Group

HydroCAD® 10.00-22 s/n 00904 © 2018 HydroCAD Software Solutions LLC

Recharge Volume Provided  
Type III 24-hr Rv Rainfall=4.30"  
Printed 11/3/2020  
Page 1

### Summary for Pond 1P: Underground Infiltration System-1

Inflow Area = 1.977 ac, 97.42% Impervious, Inflow Depth > 1.55" for Rv event  
 Inflow = 3.2 cfs @ 12.08 hrs, Volume= 0.255 af  
 Outflow = 0.0 cfs @ 6.92 hrs, Volume= 0.047 af, Atten= 99%, Lag= 0.0 min  
 Discarded = 0.0 cfs @ 6.92 hrs, Volume= 0.047 af  
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4  
 Peak Elev= 7.20' @ 23.95 hrs Surf.Area= 4,692 sf Storage= 9,084 cf

9,084 cu.ft. storage below outlet exceeds required recharge volume

Plug-Flow detention time= 349.3 min calculated for 0.047 af (18% of inflow)  
 Center-of-Mass det. time= 98.5 min ( 858.3 - 759.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	5.00'	0 cf	<b>38.75'W x 121.08'L x 3.00'H Field A</b> 14,076 cf Overall - 14,076 cf Embedded = 0 cf x 40.0% Voids
#2A	5.00'	10,260 cf	<b>StormTrap ST2 SingleTrap 2-6 x 21 Inside #1</b> Inside= 101.7"W x 30.0"H => 18.82 sf x 15.40'L = 289.8 cf Outside= 101.7"W x 36.0"H => 25.44 sf x 15.40'L = 391.6 cf 3 Rows of 7 Chambers 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System
#3	5.00'	141 cf	<b>6.00'D x 5.00'H OCS-1-Impervious</b>
		10,401 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	7.20'	<b>15.0" Round Culvert</b> L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.20' / 6.55' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

**Discarded OutFlow** Max=0.0 cfs @ 6.92 hrs HW=5.05' (Free Discharge)  
 ↗ 1=Exfiltration (Exfiltration Controls 0.0 cfs)

**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=5.00' (Free Discharge)  
 ↗ 2=Culvert (Controls 0.0 cfs)

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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## **6.03 WATER QUALITY VOLUME CALCULATIONS**

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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Water Quality Volume Calculation

$$V_{WQ} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP} \text{ square feet})$$

$V_{WQ}$  = Required Water Quality Volume (in cubic feet)

$D_{WQ}$  = Water Quality Depth: **0.5-inch**

$A_{IMP}$  = Total Impervious Area (in acres) used for driveways, parking, etc.

Underground Infiltration Systems and Bio-Retention Areas

$A_{IMP} = 88,469 \text{ sq.ft.}$

$$V_{WQ} = (1 \text{ inches}/12 \text{ inches/foot}) * (88,469 \text{ sq.ft.})$$

**$V_{WQ} = 7,372 \text{ cubic feet (required volume), provided volume} = 9,084 \text{ cubic feet (refer to the HydroCAD calculations provided in groundwater recharge section)}$**

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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## **6.04 RIP-RAP OUTLET PROTECTION SIZING**

# OUTLET PROTECTION SIZING



**Project No.** 83669.00  
**Subject** Outlet Protection Sizing Calcs  
**Location** Arlington, MA

**Calc By** EAD  
**Date** 11/2/2020  
**Checked by** DRR  
**Date** 11/3/2020

## FES-1

Q=Design Discharge, (ft<sup>3</sup>/s) = 6.6 cfs  
D=Culvert Diameter, (ft) = 1.25 ft  
TW=Tailwater Depth, (ft) = 0.5 ft, (0.4D for unknown tailwater, or enter known tailwater)  
(Tailwater depth is to be limited to between 0.4D and 1.0D)

### Riprap Rock Sizing

$$D_{50} = 0.2D \left[ \frac{Q}{\sqrt{gD^{2.5}}} \right]^{4/3} \left[ \frac{D}{TW} \right] \quad g=32.2 \text{ fps}$$

$$D_{50} = \frac{0.28}{0.28} \left[ \frac{6.60}{9.91} \right]^{(4/3)} \left[ \frac{1.25}{0.50} \right] = 0.41 \text{ ft}$$

$$= 4.88 \text{ inches}$$

Table 1 : Riprap Classes and Apron Dimensions

Class	D <sub>50</sub> (in)	Apron Length	Apron Depth	Use Class 1
1	5	4D	3.5D <sub>50</sub>	
2	6	4D	3.5D <sub>50</sub>	
3	10	5D	3.3D <sub>50</sub>	
4	14	6D	2.2D <sub>50</sub>	
5	20	7D	2.0D <sub>50</sub>	
6	22	8D	2.0D <sub>50</sub>	

### Apron Dimensions

Length, L=5D = 6 ft  
Depth=3.3D<sub>50</sub> = 16.50 Inches  
Width=3D+(2/3)L = 7.92 ft (at apron end)

Riprap Rock Sizing Gradation

Given Size	Size of Stone, inches		
100	8	to	10
85	7	to	9
50	5	to	8
15	3	to	7

# OUTLET PROTECTION SIZING



Project No. 83669.00  
 Subject Outlet Protection Sizing Calcs  
 Location Arlington, MA

Calc By EAD  
 Date 11/2/2020  
 Checked by DRR  
 Date 11/3/2020

## FES-2

Q=Design Discharge, (ft^3/s) = 2.1 cfs  
 D=Culvert Diameter, (ft) = 1.00 ft  
 TW=Tailwater Depth, (ft) = 0.4 ft, (0.4D for unknown tailwater, or enter known tailwater)  
 (Tailwater depth is to be limited to between 0.4D and 1.0D)

### Riprap Rock Sizing

$$D_{50} = 0.2D \left[ \frac{Q}{\sqrt{gD^{2.5}}} \right]^{4/3} \left[ \frac{D}{TW} \right] \quad g=32.2 \text{ fps}$$

$$D_{50} = \frac{0.28}{0.28} \left[ \frac{2.10}{5.67} \right]^{(4/3)} \left[ \frac{1.00}{0.40} \right] = 0.19 \text{ ft}$$

$$= 2.23 \text{ inches}$$

Table 1 : Riprap Classes and Apron Dimensions

Class	D <sub>50</sub> (in)	Apron Length	Apron Depth	Use Class 1
1	5	4D	3.5D <sub>50</sub>	
2	6	4D	3.5D <sub>50</sub>	
3	10	5D	3.3D <sub>50</sub>	
4	14	6D	2.2D <sub>50</sub>	
5	20	7D	2.0D <sub>50</sub>	
6	22	8D	2.0D <sub>50</sub>	

### Apron Dimensions

Length, L=5D = 5 ft  
 Depth=3.3D<sub>50</sub> = 16.50 Inches  
 Width=3D+(2/3)L = 6.33 ft (at apron end)

Riprap Rock Sizing Gradation

Given Size	Size of Stone, inches		
100	8	to	10
85	7	to	9
50	5	to	8
15	3	to	7

**Stormwater Report**

Thorndike Place

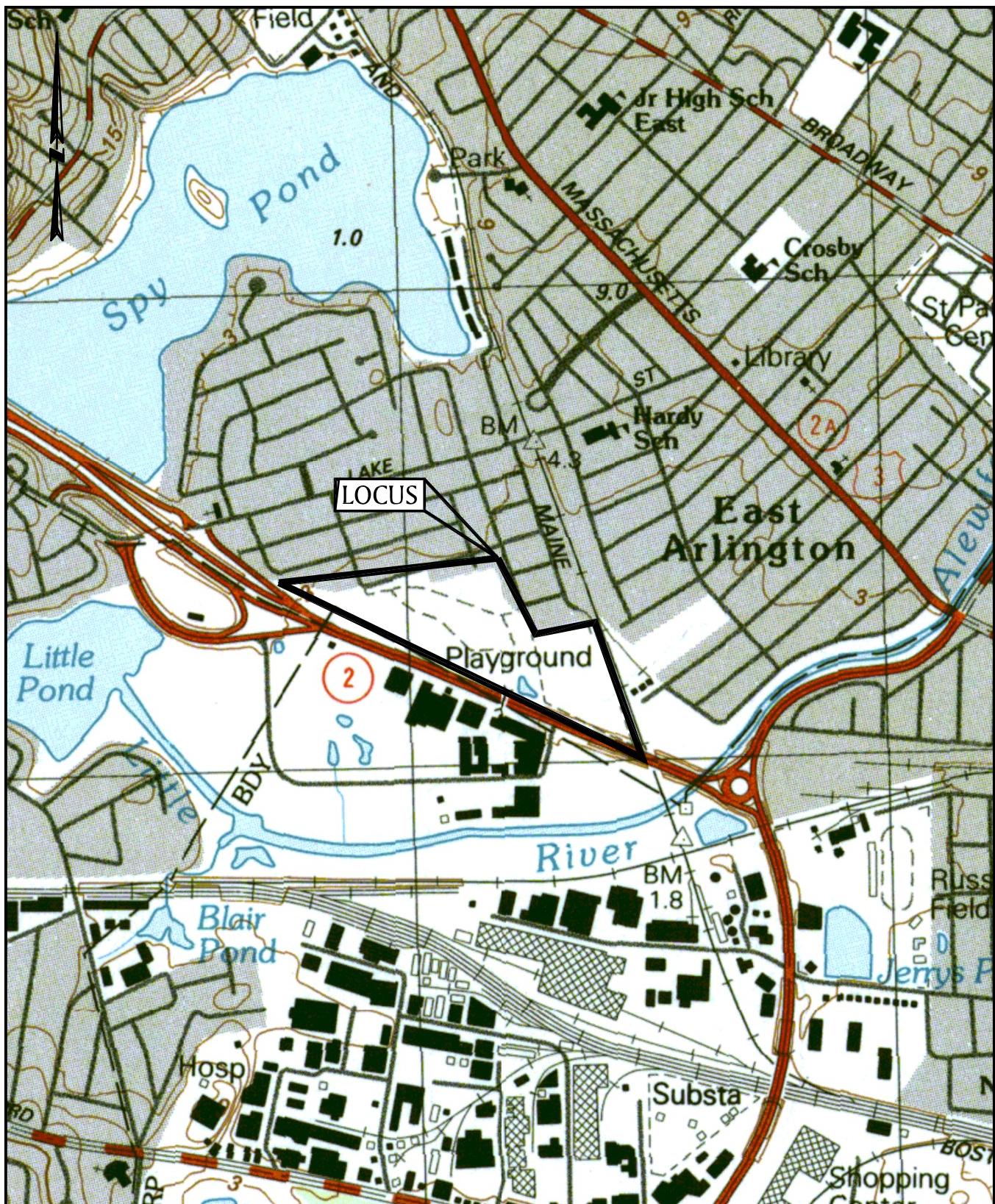
Arlington, MA

November 2020

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**APPENDIX A**

**USGS LOCUS MAP**



PREPARED FOR:

ARLINGTON LAND REALTY, LLC  
84 SHERMAN ST, 2ND FLOOR  
CAMBRIDGE, MA 02140

### USGS LOCUS MAP

THORNDIKE PLACE  
DOROTHY ROAD  
ARLINGTON, MA

 **BSC GROUP**

803 Summer Street  
Boston, Massachusetts  
02127

617 896 4300

Job No.: 234070.00	Date: 11/3/2020
Scale: 1"=1,000'	Revised:
Dwg. No: _____	150 of 257 OF 1

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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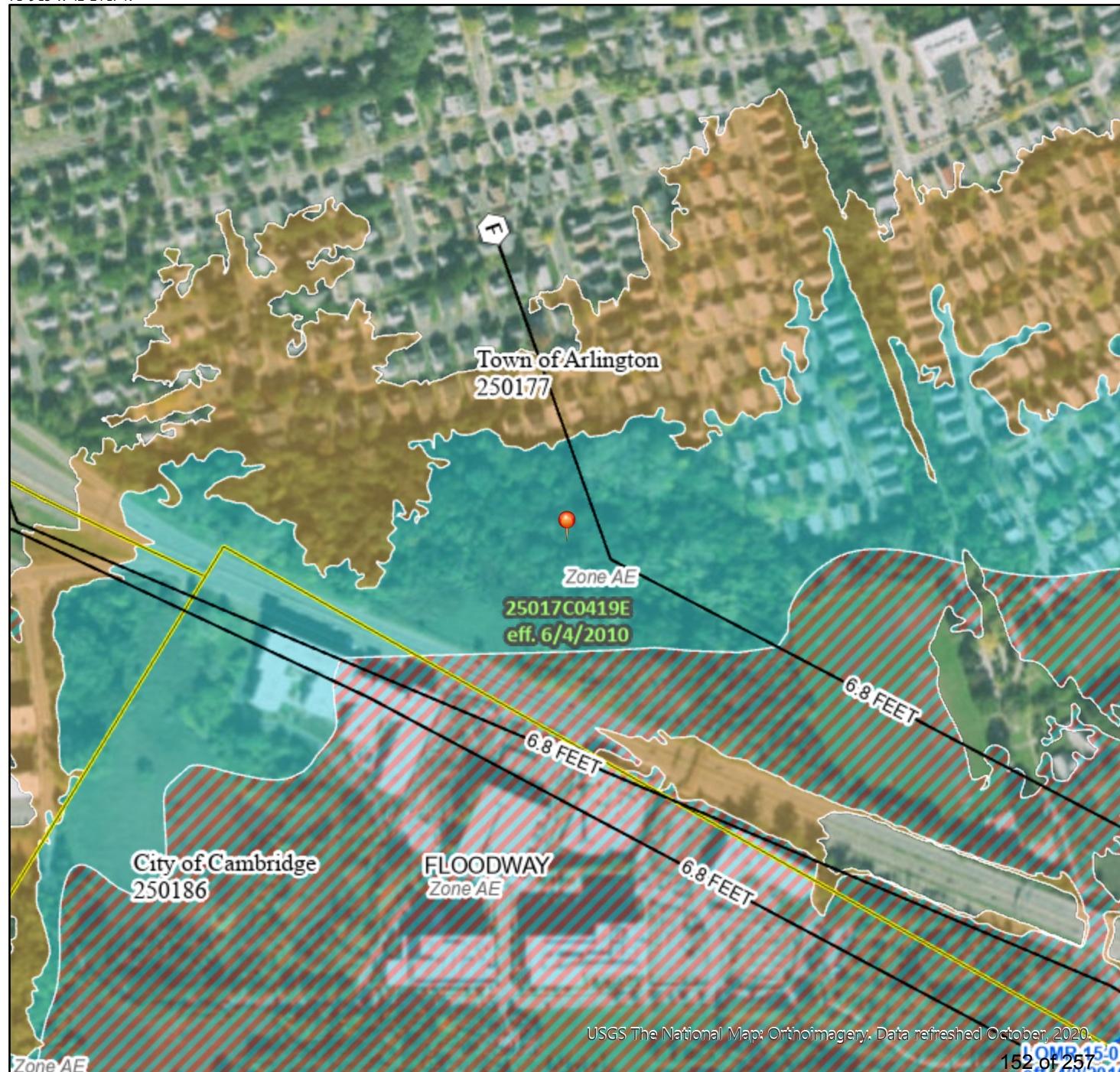
**APPENDIX B**

**FEMA MAP**

# National Flood Hazard Layer FIRMette



71°9'15"W 42°24'17"N



## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

### SPECIAL FLOOD HAZARD AREAS

	Without Base Flood Elevation (BFE) Zone A, V, A99
	With BFE or Depth Zone AE, AO, AH, VE, AR
	Regulatory Floodway

0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X

Future Conditions 1% Annual Chance Flood Hazard Zone X

Area with Reduced Flood Risk due to Levee. See Notes. Zone X

Area with Flood Risk due to Levee Zone D

### OTHER AREAS OF FLOOD HAZARD

NO SCREEN Area of Minimal Flood Hazard Zone X  
 Effective LOMRs

Area of Undetermined Flood Hazard Zone D

### OTHER AREAS

- - - Channel, Culvert, or Storm Sewer  
 ::::: Levee, Dike, or Floodwall

### GENERAL STRUCTURES

20.2 Cross Sections with 1% Annual Chance  
 17.5 Water Surface Elevation

513 Coastal Transect

Base Flood Elevation Line (BFE)

Limit of Study

Jurisdiction Boundary

- - - Coastal Transect Baseline

- - - Profile Baseline

- - - Hydrographic Feature

### OTHER FEATURES

Digital Data Available

No Digital Data Available

Unmapped



### MAP PANELS



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/2/2020 at 3:34 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

**Stormwater Report**

Thorndike Place

Arlington, MA

November 2020

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**APPENDIX C**

**WEB SOIL SURVEY**



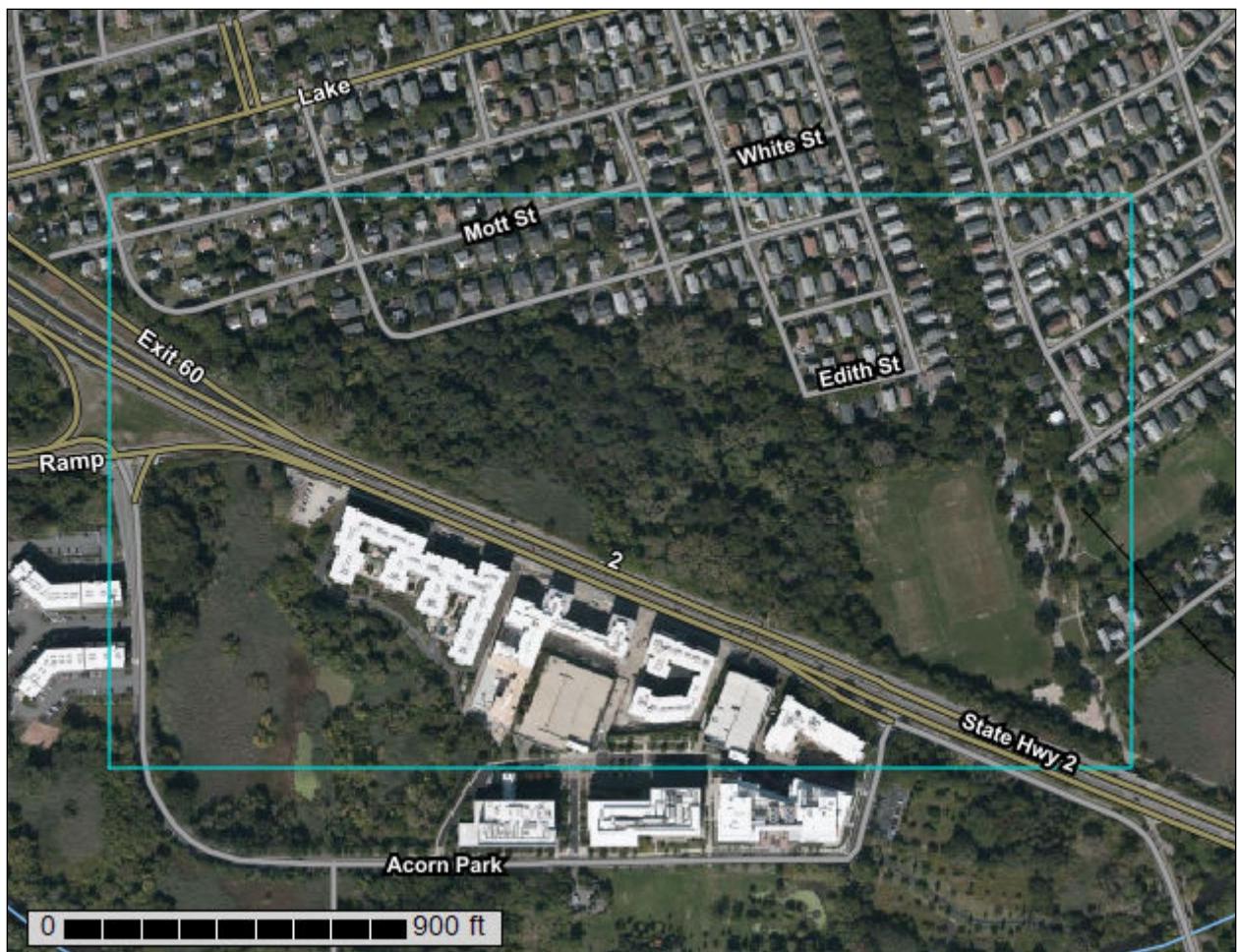
United States  
Department of  
Agriculture

**NRCS**

Natural  
Resources  
Conservation  
Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for Middlesex County, Massachusetts



# Preface

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Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# How Soil Surveys Are Made

---

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units).

Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

## Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# **Soil Map**

---

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report

## Soil Map



Map Scale: 1:4,500 if printed on A landscape (11" x 8.5") sheet.

0 50 100 200 300 Meters

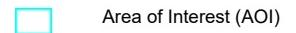
0 200 400 800 1200 Feet

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 19N WGS84

## Custom Soil Resource Report

### MAP LEGEND

#### Area of Interest (AOI)



Area of Interest (AOI)

#### Soils



Soil Map Unit Polygons



Soil Map Unit Lines



Soil Map Unit Points

#### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip

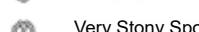


Sodic Spot

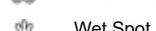
Spoil Area



Stony Spot



Very Stony Spot



Wet Spot

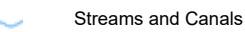


Other



Special Line Features

#### Water Features

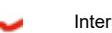


Streams and Canals

#### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

#### Background



Aerial Photography

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts

Survey Area Data: Version 20, Jun 9, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 11, 2019—Oct 5, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	4.3	4.6%
52A	Freetown muck, 0 to 1 percent slopes	10.4	11.2%
603	Urban land, wet substratum	32.1	34.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	14.3	15.4%
655	Udorthents, wet substratum	31.9	34.3%
<b>Totals for Area of Interest</b>		<b>92.9</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Middlesex County, Massachusetts

### 51A—Swansea muck, 0 to 1 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2trl2  
*Elevation:* 0 to 1,140 feet  
*Mean annual precipitation:* 36 to 71 inches  
*Mean annual air temperature:* 39 to 55 degrees F  
*Frost-free period:* 140 to 240 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Swansea and similar soils:* 80 percent  
*Minor components:* 20 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Swansea

##### Setting

*Landform:* Swamps, bogs  
*Landform position (three-dimensional):* Dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Parent material:* Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

##### Typical profile

*Oa1 - 0 to 24 inches:* muck  
*Oa2 - 24 to 34 inches:* muck  
*Cg - 34 to 79 inches:* coarse sand

##### Properties and qualities

*Slope:* 0 to 1 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Very poorly drained  
*Runoff class:* Negligible  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)  
*Depth to water table:* About 0 to 6 inches  
*Frequency of flooding:* Rare  
*Frequency of ponding:* Frequent  
*Available water capacity:* Very high (about 16.5 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 8w  
*Hydrologic Soil Group:* B/D  
*Ecological site:* F144AY043MA - Acidic Organic Wetlands  
*Hydric soil rating:* Yes

#### Minor Components

##### Freetown

*Percent of map unit:* 10 percent  
*Landform:* Bogs, swamps

*Landform position (three-dimensional): Dip  
Down-slope shape: Concave*

*Across-slope shape: Concave  
Hydric soil rating: Yes*

**Whitman**

*Percent of map unit: 5 percent*

*Landform: Depressions, drainageways*

*Landform position (two-dimensional): Toeslope*

*Landform position (three-dimensional): Base slope*

*Down-slope shape: Concave*

*Across-slope shape: Concave*

*Hydric soil rating: Yes*

**Scarboro**

*Percent of map unit: 5 percent*

*Landform: Drainageways, depressions*

*Landform position (two-dimensional): Toeslope*

*Landform position (three-dimensional): Base slope, tread, dip*

*Down-slope shape: Concave*

*Across-slope shape: Concave*

*Hydric soil rating: Yes*

## **52A—Freetown muck, 0 to 1 percent slopes**

**Map Unit Setting**

*National map unit symbol: 2t2q9*

*Elevation: 0 to 1,110 feet*

*Mean annual precipitation: 36 to 71 inches*

*Mean annual air temperature: 39 to 55 degrees F*

*Frost-free period: 140 to 240 days*

*Farmland classification: Not prime farmland*

**Map Unit Composition**

*Freetown and similar soils: 85 percent*

*Minor components: 15 percent*

*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Freetown**

**Setting**

*Landform: Depressions, depressions, bogs, marshes, kettles, swamps*

*Landform position (two-dimensional): Toeslope*

*Landform position (three-dimensional): Tread, dip*

*Down-slope shape: Concave*

*Across-slope shape: Concave*

*Parent material: Highly decomposed organic material*

**Typical profile**

*Oe - 0 to 2 inches: mucky peat*

*Oa - 2 to 79 inches: muck*

### Properties and qualities

*Slope:* 0 to 1 percent  
*Surface area covered with cobbles, stones or boulders:* 0.0 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Very poorly drained  
*Runoff class:* Negligible  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)  
*Depth to water table:* About 0 to 6 inches  
*Frequency of flooding:* Rare  
*Frequency of ponding:* Frequent  
*Available water capacity:* Very high (about 19.2 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 5w  
*Hydrologic Soil Group:* B/D  
*Ecological site:* F144AY043MA - Acidic Organic Wetlands  
*Hydric soil rating:* Yes

### Minor Components

#### Swansea

*Percent of map unit:* 5 percent  
*Landform:* Kettles, depressions, depressions, marshes, swamps, bogs  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Tread, dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

#### Scarboro

*Percent of map unit:* 5 percent  
*Landform:* Depressions, drainageways  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope, tread, dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

#### Whitman

*Percent of map unit:* 5 percent  
*Landform:* Depressions, drainageways  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

## 603—Urban land, wet substratum

### Map Unit Setting

*National map unit symbol:* 9951  
*Mean annual precipitation:* 32 to 50 inches  
*Mean annual air temperature:* 45 to 50 degrees F  
*Frost-free period:* 110 to 200 days  
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Urban land:* 85 percent  
*Minor components:* 15 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Urban Land

#### Setting

*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Excavated and filled land over alluvium and/or marine deposits

### Minor Components

#### Udorthents, loamy

*Percent of map unit:* 10 percent  
*Hydric soil rating:* No

#### Rock outcrop

*Percent of map unit:* 5 percent  
*Landform:* Ledges  
*Landform position (two-dimensional):* Summit  
*Landform position (three-dimensional):* Head slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave

## 626B—Merrimac-Urban land complex, 0 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 2tyr9  
*Elevation:* 0 to 820 feet  
*Mean annual precipitation:* 36 to 71 inches  
*Mean annual air temperature:* 39 to 55 degrees F

*Frost-free period:* 140 to 250 days

*Farmland classification:* Not prime farmland

### **Map Unit Composition**

*Merrimac and similar soils:* 45 percent

*Urban land:* 40 percent

*Minor components:* 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### **Description of Merrimac**

#### **Setting**

*Landform:* Eskers, moraines, outwash terraces, outwash plains, kames

*Landform position (two-dimensional):* Backslope, footslope, summit, shoulder

*Landform position (three-dimensional):* Side slope, crest, riser, tread

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

#### **Typical profile**

*Ap - 0 to 10 inches:* fine sandy loam

*Bw1 - 10 to 22 inches:* fine sandy loam

*Bw2 - 22 to 26 inches:* stratified gravel to gravelly loamy sand

*2C - 26 to 65 inches:* stratified gravel to very gravelly sand

#### **Properties and qualities**

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Runoff class:* Very low

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to very high (1.42 to 99.90 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 2 percent

*Maximum salinity:* Nonsaline (0.0 to 1.4 mmhos/cm)

*Sodium adsorption ratio, maximum:* 1.0

*Available water capacity:* Low (about 4.6 inches)

#### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* A

*Ecological site:* F144AY022MA - Dry Outwash

*Hydric soil rating:* No

### **Description of Urban Land**

#### **Typical profile**

*M - 0 to 10 inches:* cemented material

#### **Properties and qualities**

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* 0 inches to manufactured layer

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*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Very low (0.00 to 0.00 in/hr)

*Available water capacity:* Very low (about 0.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 8

*Hydrologic Soil Group:* D

*Hydric soil rating:* Unranked

### Minor Components

#### Windsor

*Percent of map unit:* 5 percent

*Landform:* Dunes, outwash terraces, deltas, outwash plains

*Landform position (three-dimensional):* Tread, riser

*Down-slope shape:* Convex, linear

*Across-slope shape:* Convex, linear

*Hydric soil rating:* No

#### Sudbury

*Percent of map unit:* 5 percent

*Landform:* Outwash plains, terraces, deltas

*Landform position (two-dimensional):* Foothslope

*Landform position (three-dimensional):* Tread, dip

*Down-slope shape:* Concave

*Across-slope shape:* Linear

*Hydric soil rating:* No

#### Hinckley

*Percent of map unit:* 5 percent

*Landform:* Eskers, kames, deltas, outwash plains

*Landform position (two-dimensional):* Summit, shoulder, backslope

*Landform position (three-dimensional):* Nose slope, side slope, crest, head slope, rise

*Down-slope shape:* Convex

*Across-slope shape:* Convex, linear

*Hydric soil rating:* No

## 655—Udorthents, wet substratum

### Map Unit Setting

*National map unit symbol:* vr1n

*Elevation:* 0 to 3,000 feet

*Mean annual precipitation:* 32 to 54 inches

*Mean annual air temperature:* 43 to 54 degrees F

*Frost-free period:* 110 to 240 days

*Farmland classification:* Not prime farmland

### Map Unit Composition

*Udorthents, wet substratum, and similar soils:* 85 percent

*Minor components:* 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Udorthents, Wet Substratum

#### Setting

*Parent material:* Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

#### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

### Minor Components

#### Urban land

*Percent of map unit:* 8 percent

*Landform position (two-dimensional):* Footslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

#### Freetown

*Percent of map unit:* 4 percent

*Landform:* Depressions, bogs

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Dip

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Hydric soil rating:* Yes

#### Swansea

*Percent of map unit:* 3 percent

*Landform:* Bogs, depressions

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Dip

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Hydric soil rating:* Yes

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## **Wildlife Habitat and Vegetation Evaluation**

Thorndike Place  
Dorothy Road  
Arlington, MA

November 2020



Prepared for:  
Arlington Land Realty, LLC

Matt Burne, PWS  
Senior Ecologist  
BSC Project No. 23407.00

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## LIST OF ATTACHMENTS

Attachment A: Survey Site Locations

Attachment B: Thorndike Place Wildlife Habitat and Vegetation Analysis Images

Attachment C: Field Data Collection Forms

## 1.0 INTRODUCTION

The Thorndike Place Comprehensive Permit Civil/Site peer review conducted by BETA, dated August 5, 2020, identifies several concerns pertaining to wildlife habitat and vegetation on the project site, making several recommendations for thorough wildlife habitat and vegetation evaluation.

Recommendations include providing a field evaluation of functions and values of the Isolated Vegetated Wetland (IVW) and Arlington Bylaw Adjacent Upland Resource Areas (AURAs) to determine the area's significance to interests identified in the [Arlington] Bylaw and to conduct a wildlife habitat evaluation of the 17.7-acre site focusing on resource areas and potential loss of habitat within isolated wetlands and AURA zones.

The Arlington Regulations for Wetlands Protection (June 4, 2015) define wildlife as any non-domesticated mammal, bird, reptile, amphibian, fish, mollusk, arthropod or other invertebrate [that is not a pest], and wildlife habitat as an area being used by or necessary to provide breeding or nesting habitat, shelter, food and water for any animal species.

The Massachusetts Wetlands Protection Act (WPA) defines wildlife somewhat more restrictively as all mammals, birds, reptiles and amphibians, and additionally any state-listed species (which includes invertebrates). The WPA regulations identify the important wildlife habitat functions that wetlands provide as food, shelter, migratory or overwintering areas, or breeding areas for wildlife. The regulations further recognize that it is the topography, soil structure, plant community composition and structure, and hydrologic regime that provide important wildlife habitat functions.

This report presents the findings and analysis of a field investigation of the wildlife habitat and vegetation of the Thorndike Place project site conducted on October 27, 2020 by BSC Senior Ecologist Matt Burne, PWS. Matt holds a Master of Science degree from the University of Massachusetts Amherst in Fisheries & Wildlife Conservation and was previously employed by the Massachusetts Natural Heritage & Endangered Species Program as a Vernal Pool Ecologist and Rare Species Environmental Review Biologist for almost ten years.

## 2.0 METHODS

### 2.1 DESKTOP REVIEW AND FIELD PREPARATION

Prior to conducting field data collection, a desktop assessment of the site was conducted to identify existing known resources of potential interest including:

- Rare species habitat, Massachusetts Natural Heritage and Endangered Species Program (NHESP)
- BioMap2 Core Habitat, NHESP
- Critical Natural Communities, NHESP
- Prime Agricultural Soils, Natural Resources Conservation Service
- Current and historic aerial photography, Google Earth
- Wetlands, as mapped by BSC Group
- Flood zones, Federal Emergency Management Agency (FEMA)
- Areas of Critical Environmental Concern (ACEC), Department of Conservation and Recreation
- Important Bird Areas (IBA), National Audubon Society

Field survey points were identified in advance of field work with attention to the proposed project footprint where impacts to AURA are proposed or are immediately adjacent, to flood plain areas within the proposed project footprint, and to potentially suitable locations for compensatory storage (Attachment A).

## 2.2 FIELD SURVEY

A site visit was conducted on October 27, 2020 to collect data on the vegetation characteristics and important wildlife habitat features of the project site. At each field-located survey point, a 25-foot radius plot was established and vegetation was characterized within the survey plot (field forms attached as Attachment C). Field Forms developed by the Massachusetts Natural Heritage & Endangered Species Program for Quantitative Community Characterization were used to collect standardized data within each survey plot.

In addition to vegetative characterization, each survey plot was searched for signs of wildlife and for any additional features that provide important wildlife habitat values.

Survey plot center points were recorded using the ArcGIS Field Data Collector application, with GPS accuracy of approximately 15 feet under the forest cover. Photographs were collected at each survey point to create a visual record of conditions.

## 3.0 RESULTS

### 3.1 OVERVIEW

Much of the site is characterized by a diverse, mature forest canopy with dense understory vegetation. There are many very large specimens of Silver Maple (*Acer saccharinum*) and Cottonwood (*Populus deltoides*) throughout the property, especially near the series C wetland and on the eastern portion of the project site, near Parker Street. Several invasive exotic plant species are found throughout the site, with Garlic Mustard (*Alliaria petiolata*) especially common in the understory.

In many ways, the site is generally typical of urban forest fragments. In total, the forested area of the subject site and surrounding parcels that remain under forest canopy is approximately 18.5 acres. The setting of the forest patch that remains on this site is urban, though there is a tenable green-way connection to the bike path that leads north to Spy Pond, a Natural Heritage & Endangered Species Program BioMap2 Core Habitat and Priority Habitat polygon (PH 1421) and to the Alewife Brook Reservation, which connects to the Mystic River to the north. These connections have tree cover and are generally considered green space, though there is a heavy human presence in both corridors, and they are notably narrow.

This forest fragment is therefore not entirely isolated, despite the dense development surrounding it and the presence of the Route 2 corridor to its south, which isolates it from open space connected to Little Pond and Alewife Brook to the south. There is no direct connection to the Important Bird Area at Fresh Pond to the south in Cambridge.

Evidence was detected of several common bird species and a small number of mammals typical of urban woodland patches. There were no amphibians or reptiles encountered during the site visit, but it is recognized that late October is late in the year for encountering these groups of organisms.

It is important to acknowledge the extensive encampment of homeless persons on the subject parcel, as this has a direct and significant impact on the wildlife habitat values of the property overall. In general, wildlife species will not cohabit with humans, and the presence of the large encampment and extensive areas of trash and waste spread throughout site depress any wildlife habitat values that may exist in this fragmented and isolated forest patch.

### 3.2 DESKTOP REVIEW AND FIELD PREPARATION

The status of the resources that are mapped or described by the reference material reviewed for the desktop assessment are summarized below in Table 1.

*Table 1: Results of Desktop Resource Review*

Resource	Source*	Present/Type	Comments
Rare Species Habitat	NHESP	Not present	Project site is not within mapped Priority Habitat or Estimated Habitat for rare species, as mapped in the current NHESP Rare Species Habitat Atlas (2017).
BioMap2 Core Habitat	NHESP	Not present	Project site is not within mapped BioMap2 Core Habitat, as mapped by NHESP and available through OLIVER, the MassGIS data viewer.
Critical Natural Communities	NHESP	Not present	Project site is not located within a mapped Critical Natural Community, as mapped by NHESP and available through OLIVER, the MassGIS data viewer.
Prime Agricultural Soils	NRCS	Present	Portions of the project site are mapped as Swansea Muck, identified as a Farmland of Unique Importance.
Current and historic aerial photography	Google Earth, historicalaerials	1938, 1955, 1995 - 2018	See discussion of aerial imagery below
Wetlands	MA DEP, Parcel Specific Delineation	Present	BSC has delineated wetlands on the project site.
Flood zones	FEMA	Present	Portions of the project site lie within FEMA Zone AE
Areas of Critical Environmental Concern (ACEC)	MA DCR	Not present	Project parcel does not lie within mapped ACEC, as indicated by the current data available through OLIVER.
Important Bird Areas (IBA),	NAS	Not present	The project parcel does not lie within an IBA, and the nearest mapped IBA is Fresh Pond, approximately 1200 meters away. An additional IBA, the Mystic Valley Watershed, is mapped within 1800 meters.

\*Full Organizational names:

NHESP – Natural Heritage and Endangered Species Program

NRCS – Natural resources Conservation Service

MA DEP – Massachusetts Department of Environmental Protection

NAS – National Audubon Society

#### 3.2.1 Historical Site Context

Aerial photography available on Google Earth was reviewed to evaluate changes in land use and cover type. The earliest imagery provided on the Google Earth platform was from 1935, and this image shows no change in the landscape context or use of the property over the twenty-five year period available for review.

Using historicalaerials.com, we were able to review aerial photography from 1938 and 1955, and subsequent years leading into the modern era. In the late 1930s, the property was in active farming with a

number of distinct fields defined. Route 2 had been established several years prior (1935 or so) cutting off everything to the south of the property, and housing development was beginning to hem in the property from the north, though there was still a partial connection to the Spy Pond area with the exception of housing along Lake Street which fragmented the property from Spy Pond.

By 1955, farming had clearly been abandoned on the property, and more intensive housing development had occurred in the neighborhood of Dorothy Road and Littlejohn Street. In fact, by 1955, all of the housing in the neighborhood directly north of the property was in existence.

This parcel continued to revert to forest on the abandoned agricultural fields following the 1930s, and has been physically isolated from other natural areas for nearly 100 years.

### 3.2.2 Wetlands

Wetland delineations for this project site have been conducted and contested several times over nearly 20 years. We carefully reviewed current delineations and FEMA floodplain designations to plan survey plot locations to provide useful characterization of the parcel with respect to the current, significantly reduced Revised Site Plan (September 28, 2020).

The revised plan proposes no impact to Isolated Wetland (local), Bordering Vegetated Wetland, 25' No Disturb Zones for Isolated or Bordering Vegetated Wetlands, and significantly reduces proposed impacts to 100' Buffer and AURA associated with Bordering Vegetated Wetland and to Floodplain resources on the site.

Field data collection was planned for four (4) locations in AURA-BVW, three (3) locations in FEMA Floodplain, two (2) locations in possible Compensatory Flood Storage sites, and one (1) location in a very small Isolated Area on the northeast of the site that has been delineated as a wetland previously and which has had some question raised about possible function as a vernal pool. Two of the ten survey points were situated within the encampment and were therefore not included in the survey (see below).

## 3.3 FIELD SURVEY

### 3.3.1 AURA Survey Locations

- AU-B9      Terrestrial deciduous forest with dense shrub layer  
Tree canopy 35% cover composed of Ash (20%), Norway maple (10%), Black Locust (5%)  
Shrub layer 20% cover composed of rose (15%), Chokeberry (Tr)  
Vines present include Oriental Bittersweet (20%)  
Herbaceous layer 70% composed of Garlic Mustard

Topography is gently sloping, dry loamy soil with thin litter and duff layer  
There is a large amount of downed woody debris (30% cover) with a high fuel load  
One snag > 4" DBH; few cavities observed  
Few small mammal burrows observed

Evidence of dumping including concrete and macadam  
Extensive invasive exotic plants

- AU-C10 Terrestrial deciduous forest with well-developed shrub layer  
Tree canopy 75% composed of Silver Maple (50%), Poplar (10%), Ash (10%) and Cherry (Tr)  
Shrub layer 20% cover composed of Box Elder (10%), Elm (10%)  
Vines including Oriental Bittersweet and grape present (20%)  
Herbaceous layer composed of Garlic Mustard (70%) and Japanese Knotweed (20%)
- Topography is gently sloping toward C-series wetland  
There is a large amount of downed woody debris (40% cover) with moderate fuel loads  
Three snags > 4" DBH, few cavities observed  
No small mammal burrows observed
- Evidence of human disturbance including refuse  
Extensive exotic invasive plants
- AU-C16 Terrestrial deciduous forest  
Tree canopy 65% cover with Tree of Heaven (30%), American Elm (10%), and Cherry (5%)  
Tree sub-canopy layer composed of very old fruit trees (25%)  
Tangled shrub layer of Amur Honeysuckle (5%), vines (20%) including Bittersweet  
Herbaceous layer 75% cover composed of Garlic Mustard
- Topography is gently sloping toward C-series wetland  
There is a small amount of downed woody debris (15%) with moderate fuel loads  
No snags >4" DBH; no cavities observed  
No small mammal burrows observed
- Significant amount of trash and waste materials in this location  
Extensive exotic invasive plants
- AU-D18 Terrestrial deciduous forest with relatively open understory  
Tree canopy 75% composed of Black Cherry (70%) and Silver Maple (5%)  
Tree sub-canopy and shrub layer 30% with Black Cherry, Poison Sumac, and Tree-of-Heaven  
Shrub and herbaceous layer 60% composed of American Pokeweed, Goldenrod, Buckthorn
- Topography is essentially flat  
There is only a trace amount of downed woody debris with a moderate fuel load  
There are several snags >4" DBH (Tree-of-Heaven) and Cherry; few cavities  
No small mammal burrows observed
- Immediately adjacent to the largest encampment on the property.  
Survey Plot has the least Garlic Mustard on the site  
Evidence of dumping including concrete and macadam  
Impact of highway evident

### 3.3.2 Floodplain Survey Locations

- FP-1     Terrestrial deciduous forest with moderate understory  
           Tree canopy 80% composed of Cherry (60%), Box Elder (20%) and Black Oak (5%)  
           Understory composed of brambles, Chokecherry (10%), American Pokeweed (10%)  
           Herbaceous layer 80% composed of Garlic Mustard (70%), Goldenrod (5%)
- Topography is generally flat  
     There is a moderate amount of downed woody debris (25%) and moderate fuel load  
     One snag 4" DBH present
- Invasive exotic shrubs/vines are present but sparse, including Bittersweet, Knotweed  
     There are abundant plants that produce food for wildlife  
     Some evidence of the homeless encampment, including trash within survey plot  
     Evidence of dumping including concrete and macadam
- FP-2     Terrestrial deciduous forest with fairly open understory  
           Tree canopy 80% with Ash (20%), Norway Maple (40%), Red Maple (10%), Elm (5%)  
           Tree sub-canopy and shrub layer composed of Cherry (5%), Norway Maple (5%)  
           Herbaceous layer 90% composed of Garlic Mustard, Sensitive Fern, ivy
- Topography is generally flat  
     Small amount of downed woody debris, including 18" DBH trunk, moderate fuel load
- Survey plot includes some very large trees, including specimens of 24" and 30" DBH  
     Site is close to Dorothy Road and there is evidence of yard waste dumping  
     Evidence of dumping concrete macadam
- FP-3     Located within encampment and therefore not surveyed

### 3.3.3 Possible Compensatory Storage Locations

- CS-1     Terrestrial deciduous forest with open understory  
           Tree canopy 100% composed of Norway Maple. Elm and Cherry present (Tr)  
           Understory has trace amount of Linden and Bittersweet
- Topography gently sloping to the west  
     Small amount of downed wood debris (5%) with moderate fuel load  
     No snags observed; no cavities observed  
     No small mammal burrows observed
- Some residential encroachment of lawn area, but no other evidence of impacts  
     Garlic mustard is present outside of plot at fence line
- CS-2     Located within encampment and therefore not surveyed

### 3.3.4 Isolated Area

- IA-1      Distinct topographic depression  
Cottonwood trees on edge of basin  
Knotweed and ferns in basin

This was evaluated for vernal pool habitat potential and does not meet such criteria

### 3.3.5 Wildlife Observations

Few animals were observed during the field survey on October 27, 2020. A dead Eastern gray squirrel (*Sciurus carolinensis*) was observed at the forest edge, opposite 65 Dorothy Road. An Eastern Cottontail rabbit (*Sylvilagus floridanus*) was observed near Plot IA-1. Fresh canid scat was found at Plot AU-B9. It is believed to be that of Eastern Coyote (*Canis latrans*), given apparent contents of the droppings (Photo AU-B9 #867).

Several birds were heard or observed within the forested parcel. Species included Northern Cardinal (*Cardinalis cardinalis*), Black-capped Chickadee (*Poecile atricapillus*), Blue Jay (*Cyanocitta cristata*), Downy Woodpecker (*Picoides pubescens*) and American Robin (*Turdus migratorius*).

Residents of the abutting neighborhood have stated that they have observed increased pest species activity, including rats. No evidence of rats or other pest species was observed during the field survey.

## 4.0 SUMMARY OF FINDINGS

### 4.1.1 Site Context

Fragmentation and isolation of forest patches have long-term adverse impacts on forests and wildlife habitat values associated with isolated patches. Fragmentation reduces overall forest health and leads to a loss of biodiversity, and increases invasive plants, pests, and pathogens. Isolation at the landscape scale inhibits the movement of plants and animals over the long-term.

As discussed above, the subject parcel has been isolated for nearly a century, since the construction of Route 2 on its south and the development of dense housing to its north. There is a greenway connection to Spy Pond and the Mystic River through existing bike paths, which mitigates the effects of isolation to a certain degree, but this remains a significantly isolated and therefore compromised patch of forest.

### 4.1.2 Important Wildlife Habitat Features

Survey plots were established in locations where direct impact to Arlington Bylaw Adjacent Upland Resource Areas (AURAs) is proposed or immediately adjacent, and to Floodplain sites that would be directly affected by proposed work, as well as to two locations where Compensatory Storage may be proposed for the project.

Using the Wetlands Protection Act Wildlife Habitat Protection Guidance, Appendix B: Detailed Wildlife Habitat Evaluation as a basis for site evaluation, BSC Group evaluated the project site for features that provide important wildlife habitat.

- Wetland/Aquatic Food Plants were not detected in survey plots. This is a result of locating plots primarily in AURA and floodplain locations. No plots were established within the flagged wetlands. Upland Food Plants are present on the project site, found in several of the survey plots. The project will not adversely affect availability of wetland plants that are important for wildlife food, but may marginally diminish available upland wildlife food plants. Mitigation of this impact could be accomplished with careful landscape planning.
- The property is characterized by numerous large trees, many of which are near or in excess of 30" DBH. We did not conduct an inventory of such trees as part of this evaluation, but they were present at five (5) of the eight (8) survey plots. Large trees were mostly living, and there were few dead standing trees across the site, and relatively few snags or cavities, considering the extensive amount of downed woody debris.
- The most significant feature found throughout the site is the extensive amount of downed woody debris. Each survey plot was characterized by a large amount of woody debris, from very small, typically abundant fuel wood to a number of quite large downed tree trunks. This feature can be particularly valuable to small mammals, reptiles and amphibians. The project may reduce available downed woody debris within the small amount of jurisdictional resource area proposed for alteration. However, we believe that the proportion of available woody debris on the site will not be adversely affected due to its abundance at all survey plots. Mitigation of this impact could be accomplished by placing coarse woody debris in compensatory storage areas or in AURA zones and with careful consideration in landscape design and implementation.
- Rocks, rock piles, and debris were also abundant on the project site, which can all provide valuable cover objects for small mammals, reptiles and amphibians.
- There was no suitable turtle nesting habitat, nor wetlands likely to support rare species. The large wetland on site (Series C) is dominated by Phragmites, and as such not expected to provide important waterfowl habitat.
- There are no depressions that appear to provide likely vernal pool habitat on the site.

#### 4.1.3 Invasive Species

The site is characterized by the presence of invasive exotic plant species throughout most survey plots. Garlic Mustard is especially abundant throughout the site, dominating the herbaceous layer of the forest. Garlic Mustard forms dense stands and crowds out native plants. It is also allelopathic, affecting suitability of soil to native plants. Alteration of a native flora by invasive plants is known to alter the value of forest and wetland habitats for wildlife. The abundance of Garlic Mustard, and presence of Japanese Knotweed and Oriental Bittersweet at most survey sites has a significant adverse effect on wildlife.

#### 4.1.4 Human Encampment

Two survey plots, FP-3 and CS-2, were located directly within the human encampment located on the property and therefore not surveyed. There is no suitable habitat value to an area with extensive, on-going habitation.

It is important to note the adverse effects on wildlife habitat values in the forest and wetlands on the project site resulting from the extensive human encampment. The extensive amount of trash that is spread throughout the site has a direct effect of eliminating important wildlife habitat functions. Trash may be construed to provide shelter for some species, and may attract prey organisms, but it eliminates natural

cover, may introduce toxins to soil and water resources, and expands the footprint of human habitation which most wildlife make an effort to avoid.

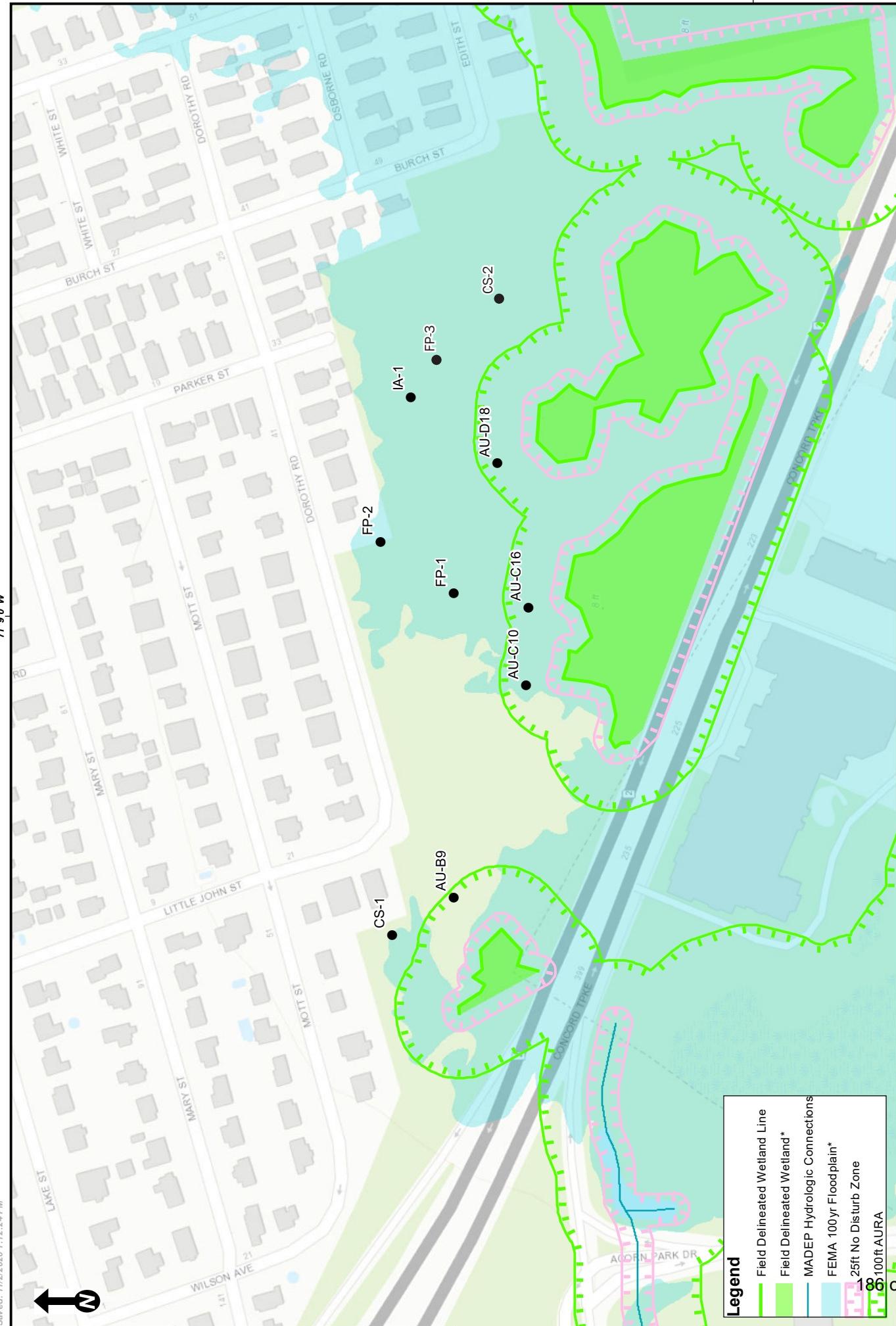
The encampment on the site of the proposed project has a direct negative impact on the wildlife habitat values of the woods and wetlands.

## 5.0 CONCLUSION

The BSC Group investigation of the Wildlife Habitat and Vegetation on the site of the proposed Thorndike Place project identified suitable resources for common wildlife species that would normally be expected in an urban/suburban forest fragment of this size. Rabbit, squirrel, and (presumed) coyote were seen, along with a variety of passerine birds. Raccoon, skunk, fox, and possibly deer, and other human-adapted or human-tolerant species are likely to occur in this patch of woods over time. Wetlands on site could also support some species of frog, and the surrounding woods might provide non-breeding habitat for these.

The site is largely isolated from surrounding natural areas which significantly reduces its wildlife habitat value. The forest's potential habitat value is further diminished by extensive invasive exotic plants throughout the site, and by the large human presence on the property.

The current revised proposed project has eliminated a significant amount of direct wetland, buffer zone, and Adjacent Upland Resource Area impacts. The project's effects on wildlife habitat values of the jurisdictional resource areas on the project site have been reduced dramatically from earlier proposals. Through careful design and implementation of flood storage mitigation areas and thoughtful, wildlife-focused landscape planning, the project should have a net beneficial outcome on the wildlife habitat values of the project site.



Scale:  
1 inch = 200 feet  
0 110 220  
Feet  
(Page Size 8.5 x 11)

Source: Sources: Esri,  
HERE, Garmin,  
Intermap, increment P  
Corp., GBCO, USGS.

**Thorndike Place, Arlington, MA**  
Wildlife Habitat and Vegetation Evaluation  
Field Survey Plot locations



**AU-B9 #866:** Survey plot has a dense tangle of bittersweet, rose, and downed woody debris. A large Ash tree dominates the canopy.



**AU-B9 #867:** Canid scat observed in Survey Plot



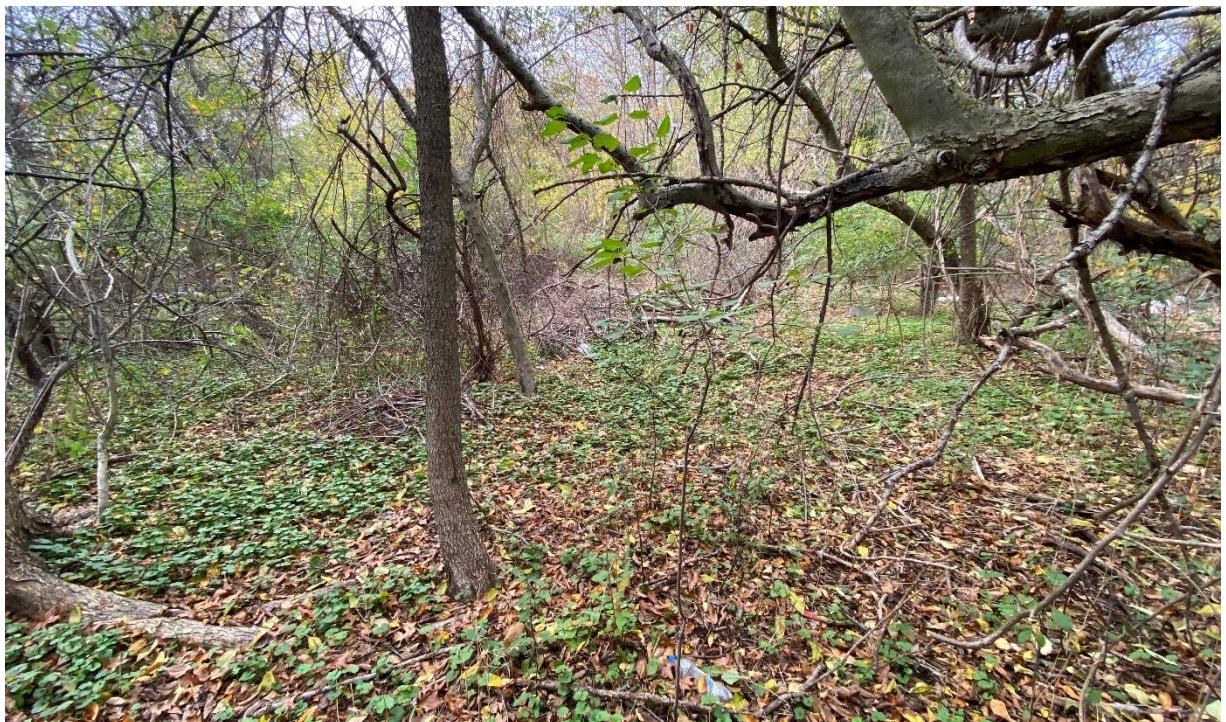
**AU-C10 #871:** Large Silver Maple tree amid generally sparse understory and moderate course woody debris



**AU-C10 #873:** Open understory with course woody debris and small stand of Japanese Knotweed



**AU-C16 #878:** Old apple/fruit trees and refuse associated with encampment.



**AU-C16 #880:** Garlic mustard understory



**AU-D18 #881:** Cherry and maple make up the canopy trees, and the understory is fairly diverse, with American Pokeweed and Goldenrod dominant.



**AU-D18 #882:** Homeless encampment has a significant effect on wildlife habitat values of forest and wetlands on the site.



**FP-1 #876:** Relatively open understory with coarse woody debris and mature overstory trees.



**FP-1 #877:** Oak and chokecherry occur over garlic mustard



**FP-2 #874:** Large mature trees in overstory, with a sparse understory and a lot of coarse woody debris.



**FP-1 #875:** Area has sensitive fern and poison ivy and other indicators of moist floodplain conditions.



**CS-1 #869:** Very open understory under complete canopy of a large Norway Maple.



**CS-1 #870:** Survey Plot was very sparse in the understory and ground cover, with some coarse woody debris.



**IA-1 #885:** Distinct depression with stand of Japanese Knotweed. No vernal pool characteristics.



**FP-1 #877:** Very large Cottonwood trees in close proximity to IA-1 depression

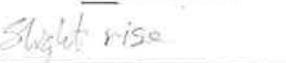
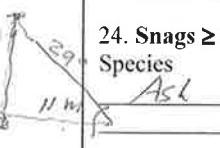
### Form 3: Quantitative Community Characterization

MA Natural Heritage & Endangered Species Program

#### A. Identifiers (general EOR information)

1. Community type (observed): \_\_\_\_\_
2. GPS Point: 42 461330 71 151239
3. Assigned type (NHESP use): \_\_\_\_\_
4. Lat: \_\_\_\_\_ N Long: \_\_\_\_\_ W
5. Site name: Thorndale Place
6. Quad name(s): \_\_\_\_\_
7. Ecoregion (DFW): \_\_\_\_\_
8. County name(s): \_\_\_\_\_
9. Town: Arlington
10. Directions: \_\_\_\_\_
11. Survey date 10/27/20
12. Previous observations at this site: \_\_\_\_\_
13. Surveyors: M. Burne

#### B. Environmental Description

<b>14. PLOT #</b> <u>AB 39</u>	<b>15. Photos taken</b> <u>Y</u> N; <u>0866, 0867</u> <b>Identifier</b> <u>MB Thorn 2</u>	<b>16. Elevation (from topo):</b> _____ m or ft
<b>17. Topographic position:</b> <input type="checkbox"/> Summit/Crest <input type="checkbox"/> High slope <input type="checkbox"/> Step in slope <input type="checkbox"/> Mid slope <input type="checkbox"/> Toe of slope <input type="checkbox"/> Low slope <input type="checkbox"/> Rolling Terrain <input type="checkbox"/> Level <input type="checkbox"/> Channel wall <input type="checkbox"/> Basin floor <input type="checkbox"/> Channel bed <input type="checkbox"/> Other <u>Slight rise</u>	<b>18. Topographic sketch:</b> 	<b>20. Slope Class (Percent):</b> <input type="checkbox"/> Flat (<2%) <input type="checkbox"/> Steep (48-95%) <input checked="" type="checkbox"/> Gentle (2-9%) <input type="checkbox"/> Very Steep (>95%) <input type="checkbox"/> Moderate (10-25%) <input type="checkbox"/> Abrupt (cliff or ledge) <input type="checkbox"/> Rather Steep (26-47%)
<b>22. Downed Wood</b> (within or partially within plot)  Max. diameter/length/decay class: <u>8"</u> <u>15'</u> <u>Partial</u>  Average diameter for all downed wood ≥4 in. <u>2.5"</u> (estimate)  Abundance of downed wood ≥4 in. diameter (using cover classes) <u>30%</u>	<b>25. Un-vegetated surface (check the single, most dominant feature):</b> <input type="checkbox"/> Bedrock <input type="checkbox"/> Large rocks (boulders > 24 in.) <input type="checkbox"/> Small rocks (stones 10-24 in.) <input type="checkbox"/> Cobbles (2-9 in.) <input type="checkbox"/> Gravel (<2 in.) <input type="checkbox"/> Sand <input type="checkbox"/> Litter <input type="checkbox"/> Bare soil <input type="checkbox"/> Water <input type="checkbox"/> Other: _____	<b>28. Moisture regime:</b> <input type="checkbox"/> Very dry <input checked="" type="checkbox"/> Dry <input type="checkbox"/> Wet <input type="checkbox"/> Moist <input type="checkbox"/> Saturated  <input type="checkbox"/> Periodically inundated <input type="checkbox"/> Permanently inundated
<b>24. Snags ≥ 4" DBH:</b> Species <u>Asl</u> DBH <u>15</u> ht. <u>20</u>  _____      _____ _____      _____ _____      _____ _____      _____ _____      _____	<b>26. Combined litter &amp; duff depth:</b> <u>2"</u> inches	<b>29. Soil type (if observed)</b> <input type="checkbox"/> sand <input checked="" type="checkbox"/> loam <input type="checkbox"/> clay <input type="checkbox"/> peat <input type="checkbox"/> <input type="checkbox"/> muck  other _____
<b>30. Sphagnum hummocks overhanging water:</b> (only if >25 m <sup>2</sup> and visible from plot) GPS point (location): _____ Size of habitat: _____ 3 water depths _____ (max. inches) Circle: Moving channels or Pools of Water Comments: _____	<b>31. Evidence of Land Use History:</b> stone walls, barbed wire, wolf trees cut stumps, multi-trunk trees, foundations, wells Other <u>Parkment, concrete</u> <u>chunks</u>	<b>32. Evidence of Disturbance:</b> <u>Fires</u> : fire scars, charcoal, standing snags <u>Blowdowns</u> : aligned downed trees <u>Ice damage</u> : broken tree tops <u>Disease</u> : adelgid, gypsy moth, beech bark Other: <u>Invasives</u>
<b>33. Environmental Comments:</b> vegetation homogeneity, erosion / sedimentation, invasive species presence/distribution, etc: <u>Robins calling</u> <u>Fresh scat - could be coyote</u> <u>Tangled understory</u> <u>Downed wood considerable, but fairly small</u>		



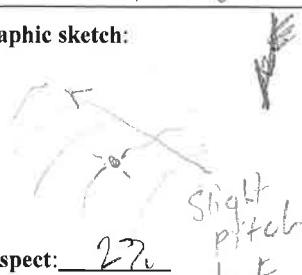
# Form 3: Quantitative Community Characterization

MA Natural Heritage & Endangered Species Program

## A. Identifiers (general EOR information)

1. Community type (observed): \_\_\_\_\_
2. GPS Point: \_\_\_\_\_
3. Assigned type (NHESP use): \_\_\_\_\_
4. Lat: \_\_\_\_\_ N Long: \_\_\_\_\_ W
5. Site name: \_\_\_\_\_
6. Quad name(s): \_\_\_\_\_
7. Ecoregion (DFW): \_\_\_\_\_
8. County name(s): \_\_\_\_\_
9. Town: Arlington
10. Directions: 80° 0' N from IWF C-10
11. Survey date 10/27/20
12. Previous observations at this site: \_\_\_\_\_
13. Surveyors: MR Burne

## B. Environmental Description

<b>14. PLOT #</b> <u>AU C10</u>	<b>15. Photos taken</b> <u>(Y)</u> N; <b>Identifier</b> <u>871, 872, 873</u>	<b>16. Elevation (from topo):</b> _____ m or ft																					
<b>17. Topographic position:</b> <input type="checkbox"/> Summit/Crest <input type="checkbox"/> High slope <input type="checkbox"/> Step in slope <input type="checkbox"/> Mid slope <input type="checkbox"/> Toe of slope <input type="checkbox"/> Low slope <input type="checkbox"/> Rolling Terrain <input type="checkbox"/> Level <input type="checkbox"/> Channel wall <input type="checkbox"/> Basin floor <input type="checkbox"/> Channel bed <input type="checkbox"/> Other	<b>18. Topographic sketch:</b> 	<b>20. Slope Class (Percent):</b> <input type="checkbox"/> Flat (<2%) <input type="checkbox"/> Steep (48-95%) <input checked="" type="checkbox"/> Gentle (2-9%) <input type="checkbox"/> Very Steep (>95%) <input type="checkbox"/> Moderate (10-25%) <input type="checkbox"/> Abrupt (cliff or ledge) <input type="checkbox"/> Rather Steep (26-47%)																					
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MA Natural Heritage & Endangered Species Program

#### A. Identifiers (general EOR information)

1. Community type (observed): \_\_\_\_\_ 2. GPS Point: 42 45109 71 150064
3. Assigned type (NHESP use): \_\_\_\_\_ 4. Lat: \_\_\_\_\_ N Long: \_\_\_\_\_ W
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7. Ecoregion (DFW): \_\_\_\_\_ 8. County name(s): \_\_\_\_\_
9. Town: Arlington 10. Directions: \_\_\_\_\_
11. Survey date 10/27/20 12. Previous observations at this site: \_\_\_\_\_
13. Surveyors: MR Cune

#### B. Environmental Description

<p>14. PLOT # <u>AL C16</u></p> <p>17. <b>Topographic position:</b>  <input type="checkbox"/> Summit/Crest  <input type="checkbox"/> High slope      <input type="checkbox"/> Step in slope  <input type="checkbox"/> Mid slope      <input type="checkbox"/> Toe of slope  <input checked="" type="checkbox"/> Low slope  <input type="checkbox"/> Rolling Terrain  <input type="checkbox"/> Level      <input type="checkbox"/> Channel wall  <input type="checkbox"/> Basin floor      <input type="checkbox"/> Channel bed  <input type="checkbox"/> Other       </p> <p>22. Downed Wood (within or partially within plot) Max. diameter/length/decay class: <u>6"</u> <u>ISPL Fresh</u> Average diameter for all downed wood ≥4 in. <u>4"</u> (estimate) Abundance of downed wood ≥4 in. diameter (using cover classes) <u>15%</u></p> <p>23. Fuel load (&lt;½ inch in diameter): Low = 1   Moderate = <u>2</u>   High = 3</p> <p>24. Snags ≥ 4" DBH: Species      DBH      ht. <u>None</u>               </p> <p>30. Sphagnum hummocks overhanging water: (only if &gt;25 m<sup>2</sup> and visible from plot) GPS point (location): _____ Size of habitat: _____ 3 water depths _____ (max. inches) Circle: Moving channels or Pools of Water Comments: _____</p>	<p>15. Photos taken <input checked="" type="checkbox"/> N; Identifier <u>0878, 0879, 0880</u></p> <p>18. Topographic sketch: </p> <p>19. Slope aspect: <u>NW</u></p> <p>25. Un-vegetated surface (check the single, most dominant feature):  <input type="checkbox"/> Bedrock  <input type="checkbox"/> Large rocks (boulders &gt; 24 in.)  <input type="checkbox"/> Small rocks (stones 10-24 in.)  <input type="checkbox"/> Cobbles (2-9 in.)  <input type="checkbox"/> Gravel (&lt;2 in.)  <input type="checkbox"/> Sand  <input type="checkbox"/> Litter  <input type="checkbox"/> Bare soil  <input type="checkbox"/> Water  <input type="checkbox"/> Other: _____       </p> <p>26. Combined litter &amp; duff depth: <u>2</u> inches</p> <p>27. Parent material: <u>loam</u></p> <p>31. Evidence of Land Use History:        stone walls, barbed wire, wolf trees        cut stumps, multi-trunk trees, foundations, wells        Other <u>old fruit trees</u>  <u>lot of trash</u> </p>	<p>16. Elevation (from topo): _____ m or ft</p> <p>20. Slope Class (Percent):  <input type="checkbox"/> Flat (&lt;2%)      <input type="checkbox"/> Steep (48-95%)  <input checked="" type="checkbox"/> Gentle (2-9%)      <input type="checkbox"/> Very Steep (&gt;95%)  <input type="checkbox"/> Moderate (10-25%)  <input type="checkbox"/> Abrupt (cliff or ledge)  <input type="checkbox"/> Rather Steep (26-47%)</p> <p>21. Slope Shape:  <b>Vertically:</b> Concave Convex Linear  <b>Horizontally:</b> Concave Convex Linear       </p> <p>28. Moisture regime:  <input checked="" type="checkbox"/> Very dry  <input checked="" type="checkbox"/> Dry      <input type="checkbox"/> Wet  <input type="checkbox"/> Moist      <input type="checkbox"/> Saturated    <input type="checkbox"/> Periodically inundated  <input type="checkbox"/> Permanently inundated       </p> <p>29. Soil type (if observed):  <input type="checkbox"/> sand      <input checked="" type="checkbox"/> loam  <input type="checkbox"/> clay      <input type="checkbox"/> peat  <input type="checkbox"/>      <input type="checkbox"/> muck          other: _____       </p> <p>32. Evidence of Disturbance:  <b>Fires:</b> fire scars, charcoal, standing snags  <b>Blowdowns:</b> aligned downed trees  <b>Ice damage:</b> broken tree tops  <b>Disease:</b> adelgid, gypsy moth, beech bark        Other: _____       </p> <p>33. Environmental Comments: vegetation homogeneity, erosion / sedimentation, invasive species presence/distribution, etc:  <u>location of encampment. lots of trash</u>  <u>Tangled understory. lots of trash</u> </p>
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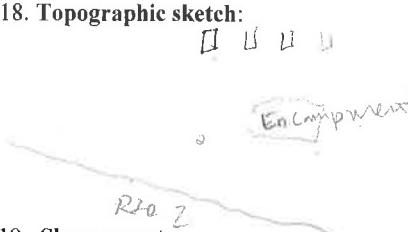
### Form 3: Quantitative Community Characterization

MA Natural Heritage & Endangered Species Program

#### A. Identifiers (general EOR information)

1. Community type (observed): \_\_\_\_\_
2. GPS Point: 42 401132 71 149118
3. Assigned type (NHESP use): \_\_\_\_\_
4. Lat: \_\_\_\_\_ N Long \_\_\_\_\_ W
5. Site name: \_\_\_\_\_
6. Quad name(s): \_\_\_\_\_
7. Ecoregion (DFW): \_\_\_\_\_
8. County name(s): \_\_\_\_\_
9. Town: Arlington 10. Directions: \_\_\_\_\_
11. Survey date 16/27/20 12. Previous observations at this site: \_\_\_\_\_
13. Surveyors: M. Brown

#### B. Environmental Description

14. PLOT # <u>Av D18</u>	15. Photos taken <u>Y</u> N; Identifier <u>0881 - 0883</u>	16. Elevation (from topo): ____ m or ft
<b>17. Topographic position:</b> <input type="checkbox"/> Summit/Crest <input type="checkbox"/> High slope <input type="checkbox"/> Step in slope <input type="checkbox"/> Mid slope <input type="checkbox"/> Toe of slope <input type="checkbox"/> Low slope <input checked="" type="checkbox"/> Rolling Terrain <input checked="" type="checkbox"/> Level <input type="checkbox"/> Channel wall <input type="checkbox"/> Basin floor <input type="checkbox"/> Channel bed <input type="checkbox"/> Other	<b>18. Topographic sketch:</b>  <b>19. Slope aspect:</b> _____	<b>20. Slope Class (Percent):</b> <input type="checkbox"/> Flat (<2%) <input type="checkbox"/> Steep (48-95%) <input type="checkbox"/> Gentle (2-9%) <input type="checkbox"/> Very Steep (>95%) <input type="checkbox"/> Moderate (10-25%) <input type="checkbox"/> Abrupt (cliff or ledge) <input type="checkbox"/> Rather Steep (26-47%)
<b>22. Downed Wood</b> (within or partially within plot)  Max. diameter/length/decay class: <u>4' 10" partial</u>  Average diameter for all downed wood ≥4 in. <u>No</u> (estimate)  Abundance of downed wood ≥4 in. diameter (using cover classes) <u>Fr.</u>  <i>There is burned wood, but most &lt;4</i>	<b>25. Un-vegetated surface (check the single, most dominant feature):</b> <input type="checkbox"/> Bedrock <input type="checkbox"/> Large rocks (boulders > 24 in.) <input type="checkbox"/> Small rocks (stones 10-24 in.) <input type="checkbox"/> Cobbles (2-9 in.) <input type="checkbox"/> Gravel (<2 in.) <input type="checkbox"/> Sand <input type="checkbox"/> Litter <input type="checkbox"/> Bare soil <input type="checkbox"/> Water <input type="checkbox"/> Other: _____	<b>28. Moisture regime:</b> <input checked="" type="checkbox"/> Very dry <input checked="" type="checkbox"/> Dry <input type="checkbox"/> Wet <input type="checkbox"/> Moist <input type="checkbox"/> Saturated  <input type="checkbox"/> Periodically inundated <input type="checkbox"/> Permanently inundated
<b>23. Fuel load (&lt; ½ inch in diameter):</b> Low = 1    Moderate = 2    High = 3	<b>26. Combined litter &amp; duff depth:</b> <u>2</u> inches	<b>29. Soil type (if observed)</b> <input type="checkbox"/> sand <input checked="" type="checkbox"/> loam <input type="checkbox"/> clay <input type="checkbox"/> peat <input type="checkbox"/> muck  other: _____
<b>24. Snags ≥ 4" DBH:</b> Species <u>Cherry</u> DBH <u>3</u> ht. <u>20</u> <u>Allianthus (5)</u> <u>4</u> <u>20</u> _____      _____      _____ _____      _____      _____ _____      _____      _____	<b>27. Parent material:</b> <u>loam</u>	<b>32. Evidence of Disturbance:</b> <b>Fires:</b> fire scars, charcoal, standing snags <b>Blowdowns:</b> aligned downed trees <b>Ice damage:</b> broken tree tops <b>Disease:</b> adelgid, gypsy moth, beech bark Other: _____
<b>30. Sphagnum hummocks overhanging water:</b> (only if >25 m <sup>2</sup> and visible from plot) GPS point (location): _____ Size of habitat: _____ 3 water depths _____ (max. inches) Circle: Moving channels or Pools of Water Comments: _____	<b>31. Evidence of Land Use History:</b> stone walls, barbed wire, wolf trees cut stumps, multi-trunk trees, foundations, wells Other <u>chunks of pavement</u>	<b>33. Environmental Comments:</b> vegetation homogeneity, erosion / sedimentation, invasive species presence/distribution, etc: <i>Ground is relatively flat w/ some topographic undulation.</i> <i>Chickadee flying. Blue Jay calling.</i> <i>Significant homeowners in campment here.</i>



## **Form 3: Quantitative Community Characterization**

MA Natural Heritage & Endangered Species Program

#### A. Identifiers (general EOR information)

1. Community type (observed): \_\_\_\_\_ 2. GPS Point: 42 40 20S 71 14 988W  
3. Assigned type (NHESP use): \_\_\_\_\_ 4. Lat: \_\_\_\_\_ N Long: \_\_\_\_\_ W  
5. Site name: \_\_\_\_\_ 6. Quad name(s): \_\_\_\_\_  
7. Ecoregion (DFW): \_\_\_\_\_ 8. County name(s): \_\_\_\_\_  
9. Town: Arlington 10. Directions: \_\_\_\_\_  
11. Survey date 10/27/20 11:30A 12. Previous observations at this site: \_\_\_\_\_  
13. Surveyors: JWBurne

### **B. Environmental Description**

14. PLOT # <b>FP 1</b>	15. Photos taken Y N; Identifier <u>0876</u> <u>0877</u>	16. Elevation (from topo): ____ m or ft
17. <u>Topographic position:</u> <input type="checkbox"/> Summit/Crest <input type="checkbox"/> High slope <input type="checkbox"/> Step in slope <input type="checkbox"/> Mid slope <input type="checkbox"/> Toe of slope <input type="checkbox"/> Low slope <input type="checkbox"/> Rolling Terrain <input type="checkbox"/> Level <input type="checkbox"/> Channel wall <input type="checkbox"/> Basin floor <input type="checkbox"/> Channel bed <input type="checkbox"/> Other <i>Flat plateau</i>	18. Topographic sketch:    	20. <u>Slope Class (Percent):</u> <input type="checkbox"/> Flat (<2%) <input type="checkbox"/> Steep (48-95%) <input type="checkbox"/> Gentle (2-9%) <input type="checkbox"/> Very Steep (>95%) <input type="checkbox"/> Moderate (10-25%) <input type="checkbox"/> Abrupt (cliff or ledge) <input type="checkbox"/> Rather Steep (26-47%)
22. <u>Downed Wood</u> (within or partially within plot)  Max. diameter/length/decay class: <i>10"</i> <i>10'</i> <i>fresh</i> Average diameter for all downed wood ≥ 4 in. <i>5"</i> (estimate) Abundance of downed wood ≥ 4 in. diameter (using cover classes) <i>25%</i>	19. <u>Slope aspect:</u> _____	21. <u>Slope Shape:</u> <u>Vertically:</u> Concave Convex <input checked="" type="checkbox"/> Linear <u>Horizontally:</u> Concave Convex <input checked="" type="checkbox"/> Linear
23. <u>Fuel load</u> (<¼-inch in diameter): Low = 1      Moderate = 2      High = 3	25. <u>Un-vegetated surface</u> (check the single, most dominant feature): <input type="checkbox"/> Bedrock <input type="checkbox"/> Large rocks (boulders > 24 in.) <input type="checkbox"/> Small rocks (stones 10-24 in.) <input type="checkbox"/> Cobbles (2-9 in.) <input type="checkbox"/> Gravel (<2 in.) <input type="checkbox"/> Sand <input type="checkbox"/> Litter <input type="checkbox"/> Bare soil <input type="checkbox"/> Water <input type="checkbox"/> Other: <hr/>	28. <u>Moisture regime:</u> <input checked="" type="checkbox"/> Very dry <input checked="" type="checkbox"/> Dry <input type="checkbox"/> Wet <input type="checkbox"/> Moist <input type="checkbox"/> Saturated  <input type="checkbox"/> Periodically inundated <input type="checkbox"/> Permanently inundated
24. <u>Snags ≥ 4" DBH:</u> Species <i>ASL</i> DBH <i>4</i> ht. <i>—</i> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	26. <u>Combined litter &amp; duff depth:</u> <i>2"</i> inches	29. <u>Soil type</u> (if observed): <input type="checkbox"/> sand <input checked="" type="checkbox"/> loam <input type="checkbox"/> clay <input type="checkbox"/> peat <input type="checkbox"/> <input type="checkbox"/> muck other _____
30. <u>Sphagnum hummocks overhanging water:</u> (only if >25 m <sup>2</sup> and visible from plot)  GPS point (location): _____ Size of habitat: _____ 3 water depths _____ (max. inches) Circle: Moving channels or Pools of Water Comments: _____	31. <u>Evidence of Land Use History:</u> stone walls, barbed wire, wolf trees cut stumps, multi-trunk trees, foundations, wells Other <i>chunks of pavement</i> <i>&amp; rocks, etc.</i>	32. <u>Evidence of Disturbance:</u> <u>Fires:</u> fire scars, charcoal, standing snags <u>Blowdowns:</u> aligned downed trees <u>Ice damage:</u> broken tree tops <u>Disease:</u> adelgid, gypsy moth, beech bark Other: _____
33. <u>Environmental Comments:</u> vegetation homogeneity, erosion / sedimentation, invasive species presence/distribution, etc: <i>Some evidence of homeless encampment</i>		

## C. VEGETATION

## 34. System:

Terrestrial

Palustrine

Estuarine

## 35. PLOT NUMBER:

FP 1

## 36. Plot Dimensions:

15' x 15' radius

37. Leaf phenology:  
 Deciduous  
 Semi-deciduous  
 Semi-Evergreen  
 Evergreen  
 Perennial  
 Annual

38. Physiognomic type:  
 Forest  
 Sparse woodland  
 Scrub thicket  
 Shrubland  
 Dwarf shrubland  
 Sparse dwarf shrubland  
 Herbaceous

39. Photo Cover-Type: \_\_\_\_\_

40. Stratatlife forms

height (in or ft)

% cover

Cover Classes

41. Plant Species & abundance: list each species and the corresponding cover class for each stratum.

39a. Field-Observed Cover Type: forest

40. Stratatlife forms

height (in or ft)

% cover

Cover Classes

<i>Cherry</i>	60	T1	Emergent tree	0	+<1%
<i>Bayberry</i>	20	T2	Tree canopy	80	1=1-5% <del>20</del>
<i>Black Oak</i>	5	T3	Tree sub-canopy	60	2=6-25%
		S1	Tall shrub	25	3=26-50%
		S2	Short shrub	15	4=51-75%
		H	Herbaceous	30	5>75%
		N	Non-vascular		
		V	Vine / liana	15	

Fairly open, sparse area, lots of CWD, & trees/shrubs that produce food

### Form 3: Quantitative Community Characterization

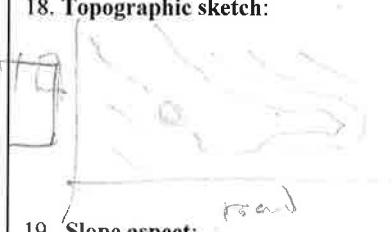
MA Natural Heritage & Endangered Species Program

MB Thru 5

#### A. Identifiers (general EOR information)

1. Community type (observed): \_\_\_\_\_
2. GPS Point: 42 40 16.43 71 14 57.72
3. Assigned type (NHESP use): \_\_\_\_\_
4. Lat: \_\_\_\_\_ N Long: \_\_\_\_\_ W
5. Site name: \_\_\_\_\_
6. Quad name(s): \_\_\_\_\_
7. Ecoregion (DFW): \_\_\_\_\_
8. County name(s): \_\_\_\_\_
9. Town: Arlington 10. Directions: \_\_\_\_\_
11. Survey date 10/27/20 12. Previous observations at this site: \_\_\_\_\_
13. Surveyors: MRB

#### B. Environmental Description

<b>14. PLOT #</b> <u>FPC</u>	<b>15. Photos taken</b> <u>Y</u> N; <u>874,875</u> <b>Identifier</b> <u>MB Thru 5</u>	<b>16. Elevation (from topo):</b> _____ m or ft
<b>17. Topographic position:</b> <input type="checkbox"/> Summit/Crest <input type="checkbox"/> High slope <input type="checkbox"/> Step in slope <input type="checkbox"/> Mid slope <input type="checkbox"/> Toe of slope <input type="checkbox"/> Low slope <input type="checkbox"/> Rolling Terrain <input checked="" type="checkbox"/> Level <input type="checkbox"/> Channel wall <input type="checkbox"/> Basin floor <input type="checkbox"/> Channel bed <input type="checkbox"/> Other	<b>18. Topographic sketch:</b> 	<b>20. Slope Class (Percent):</b> <input type="checkbox"/> Flat (<2%) <input type="checkbox"/> Steep (48-95%) <input type="checkbox"/> Gentle (2-9%) <input type="checkbox"/> Very Steep (>95%) <input type="checkbox"/> Moderate (10-25%) <input type="checkbox"/> Abrupt (cliff or ledge) <input type="checkbox"/> Rather Steep (26-47%)
<b>22. Downed Wood</b> (within or partially within plot)  Max. diameter/length/decay class: <u>18" - 25' Partial</u>  Average diameter for all downed wood $\geq$ 4 in. <u>5"</u> (estimate)  Abundance of downed wood $\geq$ 4 in. diameter (using cover classes) <u>20</u>	<b>25. Un-vegetated surface (check the single, most dominant feature):</b> <input type="checkbox"/> Bedrock <input type="checkbox"/> Large rocks (boulders > 24 in.) <input type="checkbox"/> Small rocks (stones 10-24 in.) <input type="checkbox"/> Cobbles (2-9 in.) <input type="checkbox"/> Gravel (<2 in.) <input type="checkbox"/> Sand <input type="checkbox"/> Litter <input type="checkbox"/> Bare soil <input type="checkbox"/> Water <input type="checkbox"/> Other: _____	<b>28. Moisture regime:</b> <input checked="" type="checkbox"/> Very dry <input checked="" type="checkbox"/> Dry <input type="checkbox"/> Wet <input type="checkbox"/> Moist <input type="checkbox"/> Saturated  <input type="checkbox"/> Periodically inundated <input type="checkbox"/> Permanently inundated
<b>23. Fuel load (&lt; ¼ inch in diameter):</b> Low = 1    Moderate = 2    High = 3	<b>26. Combined litter &amp; duff depth:</b> <u>2</u> inches	<b>29. Soil type (if observed)</b> <input type="checkbox"/> sand <input checked="" type="checkbox"/> loam <input type="checkbox"/> clay <input type="checkbox"/> peat <input type="checkbox"/> other _____
<b>24. Snags <math>\geq</math> 4" DBH:</b> Species <u>unk</u> DBH <u>18</u> ht. <u>7'</u> _____      _____      _____ _____      _____      _____ _____      _____      _____ _____      _____      _____	<b>30. Sphagnum hummocks overhanging water:</b> (only if $>25 \text{ m}^2$ and visible from plot) GPS point (location): <u>/</u> Size of habitat: <u>/</u> 3 water depths <u>/</u> (max. inches) Circle: Moving channels or Pools of Water Comments: _____	<b>31. Evidence of Land Use History:</b> stone walls, barbed wire, wolf trees cut stumps, multi-trunk trees, foundations, wells Other <u>Lots of pavement chunks</u>
<b>33. Environmental Comments:</b> vegetation homogeneity, erosion / sedimentation, invasive species presence/distribution, etc: <u>Close to road &amp; houses, evidence of yard dumping from neighbors</u> <u>Dad squirrel at road side</u>		<b>32. Evidence of Disturbance:</b> <u>Fires</u> : fire scars, charcoal, standing snags <u>Blowdowns</u> : aligned downed trees <u>Ice damage</u> : broken tree tops <u>Disease</u> : adelgid, gypsy moth, beech bark Other: _____



### Form 3: Quantitative Community Characterization

MA Natural Heritage & Endangered Species Program

#### A. Identifiers (general EOR information)

1. Community type (observed): \_\_\_\_\_
2. GPS Point: 42.401566 71.152019
3. Assigned type (NHESP use): \_\_\_\_\_
4. Lat: \_\_\_\_\_ N Long: \_\_\_\_\_ W
5. Site name: \_\_\_\_\_
6. Quad name(s): \_\_\_\_\_
7. Ecoregion (DFW): \_\_\_\_\_
8. County name(s): \_\_\_\_\_
9. Town: Arlington 10. Directions: laser measured 23m from back wall of house
11. Survey date 10/27/20 12. Previous observations at this site: \_\_\_\_\_
13. Surveyors: M.R.B.

#### B. Environmental Description

<p>14. PLOT # <u>CS-1</u></p> <p>17. <b>Topographic position:</b>  <input type="checkbox"/> Summit/Crest  <input type="checkbox"/> High slope      <input type="checkbox"/> Step in slope  <input type="checkbox"/> Mid slope      <input type="checkbox"/> Toe of slope  <input checked="" type="checkbox"/> Low slope  <input type="checkbox"/> Rolling Terrain  <input type="checkbox"/> Level      <input type="checkbox"/> Channel wall  <input type="checkbox"/> Basin floor      <input type="checkbox"/> Channel bed  <input type="checkbox"/> Other <u>Slight slope away from house to EBN</u> </p> <p>22. <b>Downed Wood</b>          (within or partially within plot)          Max. diameter/length/decay class:  <u>9" 12' Fresh not dec.</u>          Average diameter for all downed wood <math>\geq</math> 4 in.  <u>5"</u> (estimate)          Abundance of downed wood <math>\geq</math> 4 in. diameter          (using cover classes) <u>5%</u></p> <p>23. <b>Fuel load (&lt; ¼ inch in diameter):</b>          Low = 1    Moderate = 2    High = 3</p> <p>24. <b>Snags <math>\geq</math> 4" DBH:</b>          Species <u>None</u>      DBH _____      ht. _____          _____      _____      _____</p> <p>30. <b>Sphagnum hummocks overhanging water:</b> (only if <math>&gt;25 m^2</math> and visible from plot)          GPS point (location): _____          Size of habitat: _____          3 water depths _____ (max. inches)          Circle: Moving channels or Pools of Water          Comments: _____</p>	<p>15. Photos taken <input checked="" type="checkbox"/> N; <u>0869, 870</u>          Identifier <u>NBthorn 3</u></p> <p>18. <b>Topographic sketch:</b>  </p> <p>19. <b>Slope aspect:</b> _____</p> <p>25. <b>Un-vegetated surface (check the single, most dominant feature):</b>  <input type="checkbox"/> Bedrock  <input type="checkbox"/> Large rocks (boulders <math>&gt; 24</math> in.)  <input type="checkbox"/> Small rocks (stones 10-24 in.)  <input type="checkbox"/> Cobbles (2-9 in.)  <input type="checkbox"/> Gravel (<math>&lt; 2</math> in.)  <input type="checkbox"/> Sand  <input type="checkbox"/> Litter  <input type="checkbox"/> Bare soil  <input type="checkbox"/> Water  <input type="checkbox"/> Other: _____</p> <p>26. <b>Combined litter &amp; duff depth:</b>  <u>3"</u> inches</p> <p>27. <b>Parent material:</b> <u>Mineral soil</u></p> <p>31. <b>Evidence of Land Use History:</b>          stone walls, barbed wire, wolf trees          cut stumps, multi-trunk trees, foundations, wells          Other <u>Some overgrowth</u></p>	<p>16. <b>Elevation (from topo):</b> ____ m or ft</p> <p>20. <b>Slope Class (Percent):</b>  <input type="checkbox"/> Flat (&lt;2%)      <input type="checkbox"/> Steep (48-95%)  <input checked="" type="checkbox"/> Gentle (2-9%)      <input type="checkbox"/> Very Steep (&gt;95%)  <input type="checkbox"/> Moderate (10-25%)  <input type="checkbox"/> Abrupt (cliff or ledge)  <input type="checkbox"/> Rather Steep (26-47%)</p> <p>21. <b>Slope Shape:</b>  <b>Vertically:</b> Concave Convex <input checked="" type="radio"/> Linear  <b>Horizontally:</b> Concave Convex Linear</p> <p>28. <b>Moisture regime:</b>  <input checked="" type="checkbox"/> Very dry  <input checked="" type="checkbox"/> Dry      <input type="checkbox"/> Wet  <input type="checkbox"/> Moist      <input type="checkbox"/> Saturated    <input type="checkbox"/> Periodically inundated  <input type="checkbox"/> Permanently inundated</p> <p>29. <b>Soil type (if observed):</b>  <input type="checkbox"/> sand      <input type="checkbox"/> loam  <input type="checkbox"/> clay      <input type="checkbox"/> peat  <input type="checkbox"/>      <input type="checkbox"/> muck          other _____</p> <p>32. <b>Evidence of Disturbance:</b>  <b>Fires:</b> fire scars, charcoal, standing snags  <b>Blowdowns:</b> aligned downed trees  <b>Ice damage:</b> broken tree tops  <b>Disease:</b> adelgid, gypsy moth, beech bark          Other: _____</p> <p>33. <b>Environmental Comments:</b> vegetation homogeneity, erosion / sedimentation, invasive species presence/distribution, etc:  <u>Sparse understory, Complete overstory</u></p>
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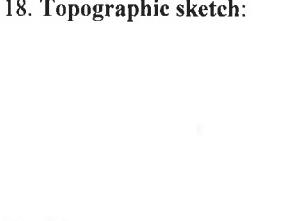
# Form 3: Quantitative Community Characterization

## MA Natural Heritage & Endangered Species Program

### A. Identifiers (general EOR information)

1. Community type (observed): \_\_\_\_\_ 2. GPS Point: \_\_\_\_\_  
 3. Assigned type (NHESP use): \_\_\_\_\_ 4. Lat: \_\_\_\_\_ N Long \_\_\_\_\_ W  
 5. Site name: \_\_\_\_\_ 6. Quad name(s): \_\_\_\_\_  
 7. Ecoregion (DFW): \_\_\_\_\_ 8. County name(s): \_\_\_\_\_  
 9. Town: Arlington 10. Directions: \_\_\_\_\_  
 11. Survey date 10/27/20 12. Previous observations at this site: \_\_\_\_\_  
 13. Surveyors: MR Burne

### B. Environmental Description

<b>14. PLOT #</b> <u>1A - 1</u>	<b>15. Photos taken</b> <u>Y</u> N; <b>Identifier</b> <u>0885, 0884</u>	<b>16. Elevation (from topo):</b> ____ m or ft
<b>17. Topographic position:</b> <input type="checkbox"/> Summit/Crest <input type="checkbox"/> High slope <input type="checkbox"/> Step in slope <input type="checkbox"/> Mid slope <input type="checkbox"/> Toe of slope <input type="checkbox"/> Low slope <input type="checkbox"/> Rolling Terrain <input type="checkbox"/> Level <input type="checkbox"/> Channel wall <input type="checkbox"/> Basin floor <input type="checkbox"/> Channel bed <input type="checkbox"/> Other <u>edge of basin</u>	<b>18. Topographic sketch:</b> 	<b>20. Slope Class (Percent):</b> <input type="checkbox"/> Flat (<2%) <input type="checkbox"/> Steep (48-95%) <input type="checkbox"/> Gentle (2-9%) <input type="checkbox"/> Very Steep (>95%) <input type="checkbox"/> Moderate (10-25%) <input type="checkbox"/> Abrupt (cliff or ledge) <input type="checkbox"/> Rather Steep (26-47%)
<b>21. Slope Shape:</b> <u>Vertically</u> : Concave Convex Linear <u>Horizontally</u> : Concave Convex Linear		
<b>22. Downed Wood</b> (within or partially within plot)  Max. diameter/length/decay class: <u>                </u>	<b>25. Un-vegetated surface (check the single, most dominant feature):</b> <input type="checkbox"/> Bedrock <input type="checkbox"/> Large rocks (boulders > 24 in.) <input type="checkbox"/> Small rocks (stones 10-24 in.) <input type="checkbox"/> Cobbles (2-9 in.) <input type="checkbox"/> Gravel (<2 in.) <input type="checkbox"/> Sand <input type="checkbox"/> Litter <input type="checkbox"/> Bare soil <input type="checkbox"/> Water <input type="checkbox"/> Other: _____	<b>28. Moisture regime:</b> <input type="checkbox"/> Very dry <input type="checkbox"/> Dry <input type="checkbox"/> Wet <input type="checkbox"/> Moist <input type="checkbox"/> Saturated  <input type="checkbox"/> Periodically inundated <input type="checkbox"/> Permanently inundated
<b>23. Fuel load (&lt; ¼ inch in diameter):</b> Low = 1   Moderate = 2   High = 3		
<b>24. Snags ≥ 4" DBH:</b> Species      DBH      ht. <u>                </u> <u>                </u> <u>                </u> <u>                </u> <u>                </u> <u>                </u>	<b>26. Combined litter &amp; duff depth:</b> <u>                </u> inches	<b>29. Soil type (if observed)</b> <input type="checkbox"/> sand <input type="checkbox"/> loam <input type="checkbox"/> clay <input type="checkbox"/> peat <input type="checkbox"/> <input type="checkbox"/> muck  other: _____
<b>30. Sphagnum hummocks overhanging water:</b> (only if >25 m <sup>2</sup> and visible from plot)  GPS point (location): <u>                </u> Size of habitat: <u>                </u> 3 water depths <u>                </u> (max. inches) Circle: Moving channels or Pools of Water Comments: _____	<b>31. Evidence of Land Use History:</b> stone walls, barbed wire, wolf trees cut stumps, multi-trunk trees, foundations, wells Other: <u>                </u>	<b>32. Evidence of Disturbance:</b> <u>Fires</u> : fire scars, charcoal, standing snags <u>Blowdowns</u> : aligned downed trees <u>Ice damage</u> : broken tree tops <u>Disease</u> : adelgid, gypsy moth, beech bark Other: _____
<b>33. Environmental Comments:</b> vegetation homogeneity, erosion / sedimentation, invasive species presence/distribution, etc:  <u>There is a slight topographic depression facing eastward</u> <u>Basin filled with knotweed. Clearly not a vernal pool</u> <u>Marsh in basin</u>		



803 Summer Street  
Boston, MA 02127

**Sent Via Email**

October 22, 2020

Tel: 617-896-4300

Christian Klein, Chair  
Arlington Zoning Board of Appeals  
51 Grove Street  
Arlington, MA 02476

[www.bscgroup.com](http://www.bscgroup.com)

RE: Thorndike Place  
Wetland Delineation

Chairman Klein:

In response to comments provided by the Arlington Conservation Commission and BETA Group, BSC Group wetland scientists have conducted a site visit on October 15, 2020 to re-evaluate the wetland delineation initially completed in January 2020. With the initial delineation completed in winter conditions, a few wetland flags were adjusted based on growing season conditions. The following information is included as attachments to this letter:

- Wetland Delineation Memorandum dated October 19, 2020
- MassDEP Bordering Vegetated Wetland Delineation Field Data Forms (5)
- Existing Environmental Resources Plan revised October 22, 2020

This information is also being transmitted electronically to the Conservation Commission and BETA Group. We also want to extend our offer to walk the site with BETA Group when the review the delineation. Please me call at 781-710-7280 or email me at [jhession@bscgroup.com](mailto:jhession@bscgroup.com) if you have any questions or require additional information.

Very truly yours,

BSC Group, Inc.



John Hession, P.E.  
Director of Land Development

Engineers

cc: zba@town.arlington.ma.us  
Richard Vallarelli, ZBA  
Emily Sullivan, Conservation  
Susan Chapnick, Conservation Commission  
Jenny Raitt, Planning and Community Development  
Marta Nover and Todd Undzis, BETA  
Stephanie Kiefer, Smolak & Vaughan  
Gwen Noyes and Arthur Klipfel, Arlington Land Realty

Environmental  
Scientists

Custom Software  
Developers

Landscape  
Architects

Planners

Surveyors

**To:** John Hession, BSC Group, Inc.  
**From:** Gillian Davies and Susan McArthur, BSC Group, Inc.  
**Re:** Wetland Delineation, Thorndike Place, Arlington, MA

**Date:** October 19, 2020  
**Proj. No.** 23407.00

## INTRODUCTION

On January 15 and on October 15 2020, BSC Group, Inc. (BSC) conducted a field delineation of wetland resource areas regulated under the *Massachusetts Wetlands Protection Act* (WPA) and associated regulations (*310 CMR 10.00 et al*) and the Town of Arlington *Wetlands Protection Bylaw* (*Article 8*) (*Bylaw*) and associated regulations (*Sections 1 through 34*) dated June 4, 2015, at the Thorndike Place/Mugar Property located off of Dorothy and Parker Roads. This primarily forested property is located between Route 2, a single-family residential neighborhood, and a local park. Site topography is relatively flat. Trash piles and debris, as well as a homeless encampment occur on the property.

## ENVIRONMENTAL RESOURCE AREA MAPPING

BSC reviewed existing mapping of environmental resources for the project site. The majority of the property is located within the FEMA 100-year floodplain and part of the site appears to be located within the floodway associated with the Little River (a Letter of Map Revision (LOMR) may be needed), as indicated on the attached Environmental Resources Map. NRCS soils maps (Web Soil Survey) indicate that Udorthents, wet substratum, Urban land, wet substratum, and Swansea muck occur on the site. According to the Massachusetts Natural Heritage and Endangered Species Program (NHESP) and the MassGIS data layer for the Massachusetts Natural Heritage Atlas, no areas of Estimated or Priority Habitat for Rare Wildlife or Certified or Potential Vernal Pools exist on the project site. BSC also reviewed the USGS topographic map.

## WETLAND RESOURCE AREA FIELD DELINEATION

In addition to reviewing relevant resource area mapping for the project site, BSC conducted an initial wetland field delineation on January 15, 2020. This wetland delineation was conducted in accordance with the MA WPA regulations, the Massachusetts Department of Environmental Protection handbook on *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (March 1995), the *Bylaw regulations*, the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region* (Version 2.0) (January 2012), and the *Field Indicators for Identifying Hydric Soils in New England* (May, 2018). BSC evaluated onsite vegetation to determine areas where 50% or more of the vegetation qualify as wetland species according to the above-mentioned regulatory documents and according to wetland indicator status as described in the *State of Massachusetts 2016 Wetland Plant List* ([http://wetland-plants.usace.army.mil/nwpl\\_static/data/DOC/lists\\_2016/States/pdf/MA\\_2016v1.pdf](http://wetland-plants.usace.army.mil/nwpl_static/data/DOC/lists_2016/States/pdf/MA_2016v1.pdf)). In accordance with the above-mentioned soils guidance documents, BSC examined soils to determine where hydric soils occur, by auguring or digging a soil pit to evaluate the top 20 inches of soil for soil texture, color, horizon thickness and depth, and presence/absence of redoximorphic features. BSC also observed the site for evidence of wetland hydrology. Due to winter conditions (lack of growing season hydrology, lack of full suite of vegetation) a decision was made to re-evaluate the wetlands at the site during the growing season. Following the same methodology, the wetland delineation was re-evaluated on October 15, 2020 and a few of the wetland flags were readjusted to accommodate growing season conditions. Wetland flags C-10, C-15 through C-17, C-17A, were moved upgradient to include a pocket of spotted touch-me-not (*Impatiens capensis*), silver maple (*Acer saccharinum*), and green ash (*Fraxinus pennsylvanica*). In addition, wetland flag D-10 was removed and the wetland line was revised to connect D-9 to D-11 based on the presence of cinnamon fern and hydric soils. Wetland data sheets were also prepared (attached).

BSC marked the boundaries of four Bordering Vegetated Wetland (BVW) areas (Series A, B, C and D) with sequentially numbered pink surveyor's tape. Additionally, BSC reviewed conditions at two potential Isolated Vegetated Wetlands (IVW) (H and I Series) that had been identified and flagged during a previous delineation on ~~11/05/2017~~ Two

other IVWs (F and G Series) had also been identified during the previous wetland delineation. BSC did not observe a predominance of wetland vegetation in the previously identified IVW areas on January 15<sup>th</sup>, 2020. The data plots performed on October 15, 2020 confirm this finding (attached). One isolated area just west of the previously flagged isolated Wetland I on the north side of the property did demonstrate hydric soils (0 – 14" 10YR 2/2, then 14 – 20 10YR 4/3 with high chroma redox and loamy sand texture), but was vegetated with predominantly upland species (multiflora rose (*Rosa multiflora*), Japanese knotweed (*Fallopia japonica*), and garlic mustard (*Alliaria petiolata*)).

Overall, BVW boundaries flagged on January 15, 2020 and readjusted on October 15, 2020 are similar to the boundaries flagged when wetlands were delineated previously in 2009. In some areas, the 2009 delineation extends upgradient of the BSC delineation, and in some areas the BSC delineation extends upgradient of the 2009 delineation. As the BSC delineation is the most recent, and wetland conditions can shift over time, BSC is of the opinion that this most recent delineation most accurately reflects conditions as they exist in the present .

BVW Series A and D are predominantly forested areas. BVW Series B is primarily forested with an area of herbaceous cover (predominantly common reed [*Phragmites australis*]), and BVW Series C is largely herbaceous common reed, with some forested area. Throughout the site, wetlands include the following tree species: red maple (*Acer rubrum*), box elder (*Acer negundo*), American elm (*Ulmus Americana*), white pine (*Pinus strobus*), ash (*Fraxinus sp.*), American Sycamore (*Platanus occidentalis*), and black willow (*Salix nigra*). Shrub and sapling species include silky dogwood (*Swida amomum*), and box elder saplings. Herbaceous species include common reed, cinnamon fern (*Osmundastrum cinnamomeum*), sensitive fern (*Onoclea sensibilis*), and goldenrod (*Solidago sp.*), and vines include poison ivy (*Toxicodendron radicans*), bittersweet (*Celastrus sp.*), greenbriar (*Smilax sp.*) and wild grape (*Vitis sp.*). In upland locations, tree species include red oak (*Quercus rubra*), white pine, cottonwood (*Populus deltoides*), box elder, and red maple. Shrubs and saplings include white pine, barberry (*Berberis sp.*), brambles (*Rubus sp.*), and multiflora rose. Herbaceous species include upland grasses and goldenrod (*Solidago sp.*), and vines include bittersweet, wild grape, and greenbriar, and poison ivy.

## REGULATORY REVIEW

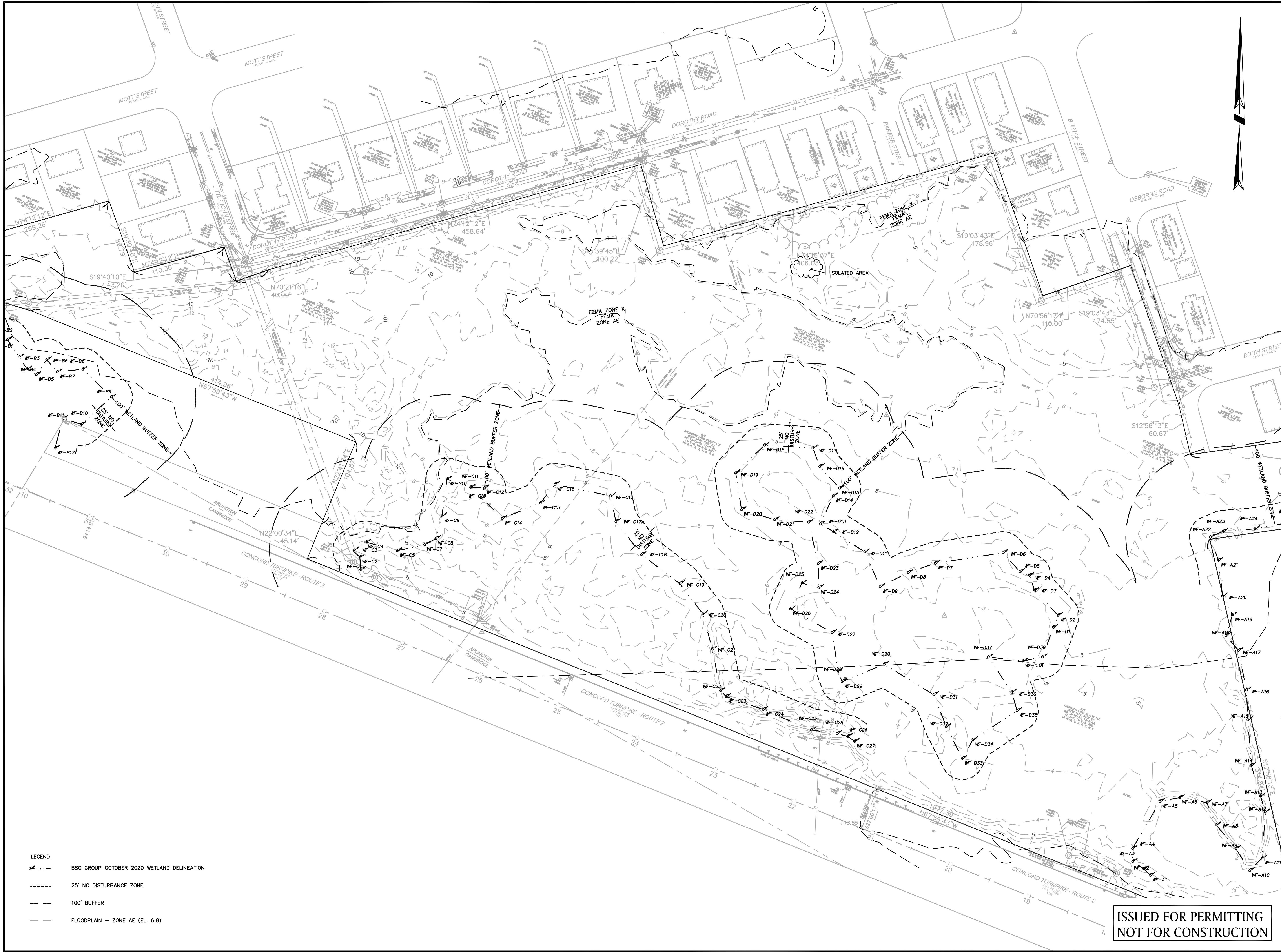
The project site contains state and locally regulated BVW and associated 100-foot buffer zones. BSC notes that the local *Bylaw regulations* identify the 100-foot buffer zone as a regulated resource area, the Adjacent Upland Resource Area (AURA). Further, the *Bylaw regulations* establish a 25-foot “No-Disturbance Zone” where no activities or work is permitted. The *Bylaw regulations* also establish a 75-foot “Restricted Zone” where impacts should be avoided and reasonable alternatives pursued.

The Bylaw regulations define Land Subject to Flooding (LSTF), as noted in *Bylaw Section 4.B. Definition number 35* and *Section 23*. Section 23 specifies that, “Compensatory flood storage shall be at a 2:1 ratio, minimum, for each unit volume of flood storage lost at each elevation.

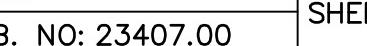
## SUMMARY

BSC has conducted a wetland delineation at the Thorndike Place/Mugar Property that is similar in extent to the previous delineation conducted in 2009. BSC notes that the site is largely within floodplain or floodway.

**cc:** Marleigh Sullivan, BSC Group, Inc.  
Ethan Sneesby, BSC Group, Inc.



# ISSUED FOR PERMITTING NOT FOR CONSTRUCTION

<hr/> DATE PROFESSIONAL ENGINEER																													
<b>THORNDIKE PLACE</b> <b>DOROTHY ROAD</b> <b>IN</b> <b>ARLINGTON</b> <b>MASSACHUSETTS</b> <b>(MIDDLESEX COUNTY)</b>																													
<b>EXISTING ENVIRONMENTAL RESOURCES PLAN</b>																													
<b>MARCH 13, 2020</b>																													
<b>REVISIONS:</b>																													
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO.</th> <th>DATE</th> <th>DESC.</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>10/22/20</td> <td>WETLAND DELINEATION</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>			NO.	DATE	DESC.	1	10/22/20	WETLAND DELINEATION																					
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1	10/22/20	WETLAND DELINEATION																											
<b>PREPARED FOR:</b> ARLINGTON LAND REALTY, LLC 84 SHERMAN STREET, 2ND FLOOR CAMBRIDGE, MA 02140																													
 <b>BSC GROUP</b> 803 Summer Street Boston, Massachusetts 02127 <hr/> 617 896 4300																													
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## MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place      Prepared by: BSC Group, Inc. (SMM & EPS)      Project location: Isolated Area, behind houses      DEP File #: \_\_\_\_\_

Check all that apply:

- Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- Method other than dominance test used (attach additional information)

### Section I.

Vegetation	Observation Plot Number: 1 (Wetland)		Transect Number: 1	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*

#### Trees

<i>Ailanthus altissima</i> / Tree of Heaven	63%	52%	Yes	NI
* <i>Acer rubrum</i> / Red maple	38%	31%	Yes	FACW+
* <i>Acer negundo</i> / Box elder	10.5%	9%	No	FAC+
* <i>Ulmus rubra</i> / Slippery elm	10.5%	9%	No	FAC

Total Percent Cover: 122%

#### Shrubs/ Saplings

* <i>Acer negundo</i> / Box elder	10.5%	100%	Yes	FAC+
-----------------------------------	-------	------	-----	------

Total Percent Cover: 10.5%

#### Herbaceous

<i>Fallopia japonica</i> / Japanese knotweed	63%	86%	Yes	FACU-
<i>Alliaria petiolata</i> / Garlic mustard	10.5%	14%	No	FACU-

Total Percent Cover: 73.5%

#### Vines

<i>Celastrus orbiculatus</i> / Asian bittersweet	10.5%	50.00%	Yes	FACU
<i>Vitis labrusca</i> / Fox grape	10.5%	50.00%	Yes	FACU

Total Percent Cover: 21%

\* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FAC-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

### Vegetation conclusion:

Number of dominant wetland indicator plants: 2

Number of dominant non-wetland indicator plants: 3

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes  no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

## Section II. Indicators of Hydrology

### Hydric Soil Interpretation

#### 1. Soil Survey

Is there a published soil survey for this site?  yes  no  
title/date: WebSoil Survey/ 2020  
map number: 655  
soil type mapped: Udorthents, wet substratum  
hydric soil inclusions: Yes

Are field observations consistent with soil survey?  yes  no

Remarks:

#### 2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
Ap	0-14"	10YR 2/1 (60%)	-	Sandy loam
		10YR 2/2 (40%)	-	
B	14"+	2.5YR 8/4 (90%)	-	Sandy loam
		10YR 7/8 (10%)	-	

Remarks: Area previously disturbed

#### 3. Other:

Conclusion: Is soil hydric?  yes  no

#### Other Indicators of Hydrology: (check all that apply & describe)

- Site Inundated: \_\_\_\_\_
- Depth to free water in observation hole: \_\_\_\_\_
- Depth to soil saturation in observation hole: \_\_\_\_\_
- Water marks: \_\_\_\_\_
- Drift lines: \_\_\_\_\_
- Sediment Deposits: \_\_\_\_\_

- Drainage patterns in BVW: \_\_\_\_\_
- Oxidized rhizospheres: \_\_\_\_\_
- Water-stained leaves: \_\_\_\_\_
- Recorded Data (streams, lake, or tidal gauge; aerial photo; other): \_\_\_\_\_
- Other: Buttressing of Ailanthus altissima

#### Vegetation and Hydrology Conclusion

Yes	No
X	

Number of wetland indicator plants  
 $\geq$  # of non-wetland indicator plants

#### Wetland hydrology present:

Hydric soil present	X
Other indicators of hydrology present	X _____

#### Sample location is in a BVW

X

Submit this form with the Request for Determination of Applicability or Notice of Intent.

# MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place Prepared by: BSC Group, Inc. (SMM & EPS) Project location: Isolated Area, behind houses DEP File #: \_\_\_\_\_

Check all that apply:

- Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- Method other than dominance test used (attach additional information)

## Section I.

Vegetation	Observation Plot Number: 2 (Upland)		Transect Number: 1	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*

### Trees

* <i>Acer negundo</i> / Box elder	85.5%	64%	Yes	FAC+
<i>Ailanthus altissima</i> / Tree of Heaven	38%	28%	No	NI
<i>Quercus alba</i> / Northern white oak	10.5%	8%	No	FACU-

Total Percent Cover: 134 %

### Shrubs/ Saplings

* <i>Acer negundo</i> / Box elder	63%	52%	Yes	FAC+
<i>Rosa multiflora</i> / Multiflora rose	38%	31%	No	FACU
* <i>Ulmus rubra</i> / Slippery elm	20.5%	17%	No	FAC

Total Percent Cover: 121.5%

### Herbaceous

<i>Alliaria petiolata</i> / Garlic mustard	85.5%	100%	Yes	FACU-

Total Percent Cover: 85.5%

### Vines

Absent

Total Percent Cover: 0%

\* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c. 131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

## Vegetation conclusion:

Number of dominant wetland indicator plants: 2

Number of dominant non-wetland indicator plants: 1

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants?  yes  no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

## Section II. Indicators of Hydrology

### Hydric Soil Interpretation

#### 1. Soil Survey

Is there a published soil survey for this site?  yes  no

title/date: WebSoil Survey/ 2020

map number: 655

soil type mapped: Udorthents, wet substratum

hydric soil inclusions: Yes

Are field observations consistent with soil survey?  yes  no

Remarks:

#### 2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
O	1-0"			
A	0-3"	10YR 2/2	-	Sandy loam
B	3-9"	10YR 3/3	-	Sandy loam

Remarks: Area previously disturbed

#### 3. Other:

Conclusion: Is soil hydric?  yes  no

#### Other Indicators of Hydrology: (check all that apply & describe)

- Site Inundated: \_\_\_\_\_
- Depth to free water in observation hole: \_\_\_\_\_
- Depth to soil saturation in observation hole: \_\_\_\_\_
- Water marks: \_\_\_\_\_
- Drift lines: \_\_\_\_\_
- Sediment Deposits: \_\_\_\_\_
- Drainage patterns in BVW: \_\_\_\_\_

- Oxidized rhizospheres: \_\_\_\_\_
- Water-stained leaves: \_\_\_\_\_
- Recorded Data (streams, lake, or tidal gauge; aerial photo; other): \_\_\_\_\_
- Other: \_\_\_\_\_

#### Vegetation and Hydrology Conclusion

Yes	No
X	

#### Wetland hydrology present:

Hydric soil present	X
Other indicators of hydrology present	X

#### Sample location is in a BVW

X	no
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Submit this form with the Request for Determination of Applicability or Notice of Intent.

## MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place      Prepared by: BSC Group, Inc. (SMM & EPS)      Project location: Arlington- Near flag D-18      DEP File #: \_\_\_\_\_

Check all that apply:

- Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- Method other than dominance test used (attach additional information)

### Section I.

Vegetation	Observation Plot Number: 1 (Wetland)		Transect Number: 2	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*

#### Trees

* <i>Acer negundo</i> / Boxelder	20.5%	32%	Yes	FAC+
* <i>Acer saccharinum</i> / Silver maple	20.5%	32%	Yes	FACW
<i>Populus tremula</i> / Quaking aspen	20.5%	32%	No	FACU
<i>Prunus serotina</i> / Black cherry	3%	5%	No	FACU

Total Percent Cover: 64.5%

#### Shrubs/ Saplings

* <i>Rhamnus frangula</i> / Glossy buckthorn	20.5%	55%	Yes	FAC
* <i>Acer saccharinum</i> / Silver maple	10.5%	28%	Yes	FACW
* <i>Fraxinus pennsylvanica</i> / Green ash	3%	8%	No	FACW
<i>Rubus strigosus</i> / Common red raspberry	3%	8%	No	FAC-

Total Percent Cover: 37%

#### Herbaceous

* <i>Onoclea sensibilis</i> / Sensitive fern	85.5%	100%	Yes	FACW
----------------------------------------------	-------	------	-----	------

Total Percent Cover: 89%

#### Vines

Absent

Total Percent Cover: 0%

\* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

### Vegetation conclusion:

Number of dominant wetland indicator plants: 4

Number of dominant non-wetland indicator plants: 0

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants?  yes  no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

## Section II. Indicators of Hydrology

### Hydric Soil Interpretation

#### 1. Soil Survey

Is there a published soil survey for this site?  yes  no  
title/date: WebSoil Survey/ 2020  
map number: 51A  
soil type mapped: Swansea muck  
hydric soil inclusions: Yes

Are field observations consistent with soil survey?  yes  no

Remarks:

#### 2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
Oe	0-0.5"			
A	0-1"	10YR 2/1	-	Mucky modified SL
Ae	1-4"	10YR 4/2	5YR 3/4 (5%)	Mucky modified sandy loam
Bg	4-14"	2.5YR 6/3	7.5YR 4/6 (12%)	sandy loam

Remarks:

#### 3. Other:

Conclusion: Is soil hydric?  yes  no

#### Other Indicators of Hydrology: (check all that apply & describe)

- Site Inundated: \_\_\_\_\_
- Depth to free water in observation hole: \_\_\_\_\_
- Depth to soil saturation in observation hole: \_\_\_\_\_
- Water marks: \_\_\_\_\_
- Drift lines: \_\_\_\_\_
- Sediment Deposits: \_\_\_\_\_

- Drainage patterns in BVW: \_\_\_\_\_
- Oxidized rhizospheres: \_\_\_\_\_
- Water-stained leaves: \_\_\_\_\_
- Recorded Data (streams, lake, or tidal gauge; aerial photo; other): \_\_\_\_\_
- Other: \_\_\_\_\_

#### Vegetation and Hydrology Conclusion

Yes                          No

Number of wetland indicator plants  
 $\geq$  # of non-wetland indicator plants

X

#### Wetland hydrology present:

- Hydric soil present                          X
- Other indicators of hydrology present                          X\_\_\_\_\_

#### Sample location is in a BVW

X

Submit this form with the Request for Determination of Applicability or Notice of Intent.

## MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place      Prepared by: BSC Group, Inc. (SMM & EPS)      Project location: Arlington- Near flag D-18      DEP File #: \_\_\_\_\_

Check all that apply:

- Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- Method other than dominance test used (attach additional information)

### Section I.

Vegetation	Observation Plot Number: 2 (Upland)		Transect Number: 2	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*

#### Trees

<i>Prunus serotina</i> / Black cherry	63%	75%	Yes	FACU
<i>Ailanthus altissima</i> / Tree of Heaven	20.5%	25%	No	NI
<i>Total Percent Cover: 83.5%</i>				

#### Shrubs/ Saplings

<i>Rhus hirta</i> / Staghorn sumac	20.5%	49%	Yes	NI
<i>Prunus serotina</i> / Black cherry	10.5%	25%	Yes	FACU
<i>Rubus strigosus</i> / Common red raspberry	10.5%	25%	No	FAC-
<i>Total Percent Cover: 41.5%</i>				

#### Herbaceous

<i>Solidago canadensis</i> / Canada goldenrod	38%	65%	Yes	FACU
<i>Phytolacca americana</i> / American pokeweed	20.5%	35%	No	FACU+
<i>Total Percent Cover: 58.8%</i>				

#### Vines

Absent

*Total Percent Cover: 0%*

\* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

### Vegetation conclusion:

Number of dominant wetland indicator plants: 0

Number of dominant non-wetland indicator plants: 4

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes  no   
If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

## Section II. Indicators of Hydrology

### Hydric Soil Interpretation

#### 1. Soil Survey

Is there a published soil survey for this site?  yes  no  
title/date: WebSoil Survey/ 2020  
map number: 51A  
soil type mapped: Swansea muck  
hydric soil inclusions: Yes

Are field observations consistent with soil survey?  yes  no

Remarks:

#### 2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
A	0-1"	10YR 2/2		
Bw <sub>1</sub>	1-6"	10YR 3/3	-	Sandy loam
Bw <sub>2</sub>	6-12+"	10YR 4/4	-	Sandy loam

Remarks:

#### 3. Other:

Conclusion: Is soil hydric?  yes  no

#### Other Indicators of Hydrology: (check all that apply & describe)

- Site Inundated: \_\_\_\_\_
- Depth to free water in observation hole: \_\_\_\_\_
- Depth to soil saturation in observation hole: \_\_\_\_\_
- Water marks: \_\_\_\_\_
- Drift lines: \_\_\_\_\_
- Sediment Deposits: \_\_\_\_\_
- Drainage patterns in BVW: \_\_\_\_\_
- Oxidized rhizospheres: \_\_\_\_\_

- Water-stained leaves: \_\_\_\_\_
- Recorded Data (streams, lake, or tidal gauge; aerial photo; other): \_\_\_\_\_
- Other: \_\_\_\_\_

#### Vegetation and Hydrology Conclusion

Yes	No
X	

Number of wetland indicator plants  
 $\geq$  # of non-wetland indicator plants

#### Wetland hydrology present:

Hydric soil present	X
Other indicators of hydrology present	X _____

#### Sample location is in a BVW

form with the Request for Determination of Applicability or Notice of Intent.

## MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place      Prepared by: BSC Group, Inc. (SMM & EPS)      Project location: Arlington- Near flag C-14      DEP File #: \_\_\_\_\_

Check all that apply:

- Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- Method other than dominance test used (attach additional information)

### Section I.

Vegetation	Observation Plot Number: 1 (Wetland)		Transect Number: 3	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*

#### Trees

*Populus deltoides/ Eastern cottonwood	20.5%	40%	Yes	FAC
Ailanthus altissima/ Tree of Heaven	20.5%	40%	Yes	NI
*Fraxinus pennsylvanica/ Green ash	10.5%	20%	Yes	FACW
<i>Total Percent Cover: 51.5 %</i>				

#### Shrubs/ Saplings

Rhus hirta/ Staghorn sumac	20.5%	60%	Yes	NI
*Populus deltoides/ Eastern cottonwood	10.5%	31%	Yes	FAC
Rosa multiflora/ Multiflora rose	3%	9%	No	FACU
<i>Total Percent Cover: 34%</i>				

#### Herbaceous

*Solidago patula/ Rough stem goldenrod	38%	53%	Yes	OBL
Phytolacca americana/ American pokeweed	20.5%	28%	Yes	FACU+
*Rubus hispida/ Creeping dewberry	10.5%	15%	No	FACW
*Phragmites australis/ Common reed	3%	4%	No	FACW
<i>Total Percent Cover: 72%</i>				

#### Vines

Absent

*Total Percent Cover: 0%*

\* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

### Vegetation conclusion:

Number of dominant wetland indicator plants: 4

Number of dominant non-wetland indicator plants: 1

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants?  yes  no  
If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

## Section II. Indicators of Hydrology

### Hydric Soil Interpretation

#### 1. Soil Survey

Is there a published soil survey for this site?  yes  no  
title/date: WebSoil Survey/ 2020  
map number: 655  
soil type mapped: Udorthents, wet substratum  
hydric soil inclusions: Yes

Are field observations consistent with soil survey?  yes  no  
Remarks:

#### 2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
A	0-1"	10YR 2/1	-	Sandy loam
Bc	1-14"+	10YR 4/2	Depletion: 7.5YR 4/6 (12%) 10YR 6/2 (10%)	Sandy loam

Remarks:

#### 3. Other:

Conclusion: Is soil hydric?  yes  no

#### Other Indicators of Hydrology: (check all that apply & describe)

- Site Inundated: \_\_\_\_\_
- Depth to free water in observation hole: \_\_\_\_\_
- Depth to soil saturation in observation hole: \_\_\_\_\_
- Water marks: \_\_\_\_\_
- Drift lines: \_\_\_\_\_
- Sediment Deposits: \_\_\_\_\_
- Drainage patterns in BVW: \_\_\_\_\_ Present\_\_\_\_\_

- Oxidized rhizospheres: \_\_\_\_\_
- Water-stained leaves: \_\_\_\_\_
- Recorded Data (streams, lake, or tidal gauge; aerial photo; other): \_\_\_\_\_
- Other: \_\_\_\_\_

#### Vegetation and Hydrology Conclusion

Number of wetland indicator plants  
 $\geq$  # of non-wetland indicator plants

Yes	No
	X

#### Wetland hydrology present:

Hydric soil present

X

Other indicators of hydrology present

X

#### Sample location is in a BVW

X

*Submit this form with the Request for Determination of Applicability or Notice of Intent.*

To: Arlington Zoning Board of Appeals  
Fr: Stephanie Kiefer, Smolak & Vaughan, LLP  
Date: November 3, 2020  
Re: Thorndike Place, ZBA Docket No.

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**STATEMENT OF DEMONSTRATION OF COMPLIANCE WITH ARLINGTON'S MASTER PLAN,  
HOUSING PRODUCTION PLAN, AND OPEN SPACE AND RECREATION PLAN**

This memorandum is submitted on behalf of Arlington Land Realty, LLC (“ALR”) in further support of its proposed Comprehensive Permit Application pending before the Board. Within ALR’s Comprehensive Permit Application, an initial statement was provided regarding the Applicant’s proposal and its consistency with sustainable development principles, including the Project’s consistency with the Arlington Master Plan and Housing Production Plan. See Application, Sections I.C and IV.G. As indicated in our September 25, 2020 Supplemental Response to Completeness Review Memo and in light of the recent project design change, as presented to the Board at its October 13 public hearing, we are pleased to provide this update, identifying the relevant provisions within Arlington’s Master Plan, Housing Production Plan and Open Space and Recreation Plan and demonstrating the Project’s furtherance of such goals set out in these municipal plans.

**CONSISTENCY WITH ARLINGTON'S MASTER PLAN**

The 2015 Master Plan establishes a number of Key Findings, Recommendations and Goals under topical categories of land use, traffic and circulation, housing, natural resources and open space, public facilities and services. Notably, the Thorndike Place 40B project is responsive to the Town’s recommendations and otherwise advances a number of the very goals that the Town has identified within the Master Plan.

**I. ALR's Thorndike Place 40B Notably Advances Salient Affordable Housing Key Findings, Policies and Recommendations Described Within the Master Plan.**

As described in the Master Plan, Key Finding 8 succinctly states although Arlington has had some success in creating affordable housing (limited to 140 units from 2000-2015), “despite efforts by the Town, the HCA and the Arlington Housing Authority (AHA), **Arlington has lost some of its traditional affordability.**” [Master Plan, p.8]. According to the Town’s website, as of 2018, the percentage of Arlington’s Subsidized Housing Inventory (“SHI”) remains stagnant at 5.6%, well below the state 10% statutory goal. According to DHCD records, as of 2020, Arlington has 1,122 SHI units. The municipal website states that in the nearly two decade period (2000-2018), Arlington has increased its percent of affordable housing by only .1%.

- **Arlington Has Lost Some its Traditional Affordability [Finding 8, Master Plan, P.8]**

The Master Plan points out the need for housing all demographics, including families, elderly and households with low and or moderate incomes. “The US Census Bureau estimates that 32% of all households in Arlington spend more than 30 percent of their gross income on housing... *Moreover, half of Arlington’s lower income homeowners are severely cost burdened, i.e., households that spend over 50 percent of their income on housing....*” [Master Plan, p.84 (emphasis supplied)]. The Master Plan also documents that 44% of Arlington renters have low or moderate incomes *and almost 80 percent are housing cost burdened.*” [Id. (emphasis supplied)]. Further, the Master Plan cautions that the rising housing costs in Arlington “make it more difficult to preserve the social mix that many people characterize as one of [Arlington’s] strengths.” [Master Plan., p.87].

**In response** to this serious deficit in affordable housing, the Thorndike Place 40B development will create 176 rental units available to families, individuals, seniors as well as individuals, including low or moderate income individuals, families and seniors. The creation of this multifamily housing project not only addresses the affordable housing need in Arlington, but it also provides greater housing choice to those individuals who either may be downsizing and/or unable to enter into the ownership housing market at this time. Moreover, 44 units at Thorndike Place will be set aside as permanently affordable to low and moderate income families. Because Thorndike Place is a 40B rental housing development, however, *all 176 units* will be counted towards Arlington’s SHI unit count. The addition of 176 units will increase the amount of Arlington’s SHI housing by close to one percent (i.e., approximately .85%). Upon certification of its Housing Production Plan, Arlington could then avail itself of a one year “safe harbor” under 760 CMR 56.03 for newly proposed 40B projects.

- **The Master Plan Identifies the Mugar Site As One of Two Possible Vacant Parcels Available to Address the Municipal Housing Need. [Master Plan, p.87].**

The Master Plan identifies “Issues and Opportunities” to address Arlington’s affordable housing need. In particular, the Master Plan specifically notes that Arlington generally has a lack of vacant land available for new housing construction. [Master Plan, p.87]. The Master Plan identifies two possible undeveloped areas in the town as possible housing sites: a) the Mugar site and b) a 6.4 acre site abutting Poets’ Corner. [Id.]<sup>1</sup>

As to the Mugar site, the Master Plan implicitly recognizes that under the existing zoning designation (Planned Unit Development), the site is appropriate for housing, but notes that a large portion of the property is within the flood zone. [Master Plan, p.88].

**In response**, the Thorndike Place proposed project, as revised, is notably consistent with the Master Plan’s recognition of the Mugar site as an affordable housing site “opportunity.” In fact, since the Housing Appeal’s Committee’s favorable ruling on the GLAM challenge, which returned the ALR 40B project to the ZBA for review, the Applicant’s engineers at BSC Group have fully surveyed the property and located the current FEMA floodplain as it exists on the site.

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<sup>1</sup> As to Poets’ Corner site, the Master Plan recognizes that its higher value may be for non-residential development given its highway proximity.

While a large floodplain area does exist on the 17+ acre site, the north/northwesterly portion of the site is completely outside of the floodplain. The large size of the Mugar site allows for both goals of the creation of affordable housing and the protection of floodplain to coexist.

The revised project design mindfully reduces the total building footprint by: a) eliminating the 6 townhouse buildings along Dorothy Road; and b) reducing the footprint of the multifamily building and shifting it to the north and west, predominantly outside the floodplain. As revised, the multifamily building presents very limited impact within the floodplain, i.e., limited portions of the easterly side of the building in two shallow fingers of floodplain. While the Master Plan has noted the lack of vacant parcels to create housing, and has expressly identified the Mugar land as one such parcel, Applicant's revised 40B project plan demonstrates the ability to both make productive use of this site for housing purposes and to otherwise leave the majority of the site undeveloped.

- **Thorndike Place Advances Two of the Four Master Plan's Housing "Goals and Policies": (a) Creating Housing Variety for a Range of Incomes, Family Size and Needs and (b) Encouragement of Sustainable Construction.**

The Master Plan identifies four "Goals and Policies" with respect to housing:

- 1) Encourage mixed use development that includes affordable housing;
- 2) Provide a variety of housing options for a range of incomes, ages, family sizes and needs;
- 3) Preserve the "streetcar suburb" character; and
- 4) Encourage sustainable construction/renovation of new and existing structures.

[Master Plan. p.10].

**In response**, the Thorndike Place 40B project proposal advances two of the Master Plans' stated "Goals and Policies." The proposed project advances the municipal goal of providing a variety of housing options for various sectors of the population. Also, the proposed project will advance sustainable construction and development of the site, addressing multiple municipal goals of preserving valuable floodplain and responding to the long overdue need for affordable rental housing options in Arlington.

- (i) The Thorndike Place Project Provides A Variety Of Housing Options For A Range Of Incomes, Ages, Family Sizes And Needs. [Master Plan, p.10].

Thorndike Place is proposed to consist of 176 rental units, consisting of a mix of studio, one-, two-, and three-bedroom units. The range of unit sizes will appeal to single adults, families as well as Arlington's aging population and/or empty nesters. The broad appeal of Thorndike Place is based not only on its full suite of unit sizes, but also its proximity to public transportation, to nearby shopping and to the Minuteman Bike Path and other outdoor recreation areas. The proximity to the Alewife MBTA Station allows for both working adults and retired adults an affordable housing option with nearby access to public transportation without undue reliance on automobiles. The Alewife Station serves the Red Line as well as a number of MBTA bus routes, including Route 62, Route 67, Route 76, Route 79, Route 84, Route 350 and Route

351. In addition, due to the proximity of the Minuteman Bike Path, the residents have multi-modal options, including walkable access, bicycles, subway and bus.

Consistent with 40B requirements, the Project will include 25% of the project (44 units) as available to low and moderate income residents. Because the development is a rental development, the Town will be able to include all 176 units as eligible SHI units. In practical terms, the increase in affordable housing units is greater than .5% of the total housing units and will allow the Town to have its HPP certified and to avail itself of a 40B “safe harbor” under 760 CMR 56.04(4)(f).

(ii) **Thorndike Place Encourages/Utilizes Sustainable Construction Practices.**

Consistent with the Master Plan’s housing goal of encouraging sustainable construction, Thorndike Place promotes such a goal on multiple levels. First, Thorndike Place is sustainably planned and engineered. As stated previously, the majority of the 17+ acre site will remain open, undeveloped and will be restricted from development in the future by use of a conservation restriction or similar land conservation mechanism. Aside from the very important goal of increasing affordable housing stock and housing diversity in Arlington, the ability for the Town to secure a permanent protection for the majority of the Mugar site is significant.

Second, and with respect to the developed portion of the site, the Applicant has established a sustainable and low impact development. The revised project design keeps the amount of impervious surface largely limited to the building and the access drive and small surface parking area in the northwest corner. Further, the building construction will use modular GreenStaxx units. The modular design and building system reduces and/or repurposes construction waste, uses green materials and relies upon residential sustainable design standards (LEED) as the benchmark. Typical construction impacts are dramatically reduced through the use of the state-of-the-art modular system. Further, the proposed building proposes the use of blue roofs, i.e., water detention on the roof which decreases impacts in storm events and flooding risks. Rooftop water detention can also keep the building cooler in warmer months, reducing the need for air conditioning and thereby reducing electricity consumption.

● **Thorndike Place Builds Upon the Master Plan’s Housing Recommendations That “Arlington Plan for Affordable Housing.” [Master Plan, pp. 13, 88].**

Two of the Master Plan’s “Key Recommendations” specifically address compliance with Chapter 40B and the need to increase affordable housing consistent with a Housing Production Plan. [Master Plan, Housing Recommendations 1 and 2, p.13]. Housing Recommendation 1 is to “create an affordable housing plan.” [Id.]. Implicit in the creation of a housing plan, the municipality must effectuate the plan. As discussed below, Arlington had set a target of increasing affordable housing by roughly 100 units per year. Although in the years since its adoption, the Town has fallen far short of that goal, the Thorndike Place project notably advances the HPP’s goal of creating affordable housing; giving the Town greater control to plan for future housing and allowing for the Town to reach a safe harbor milestone. Housing Recommendation 2 is that the Town allocate its resources to both meet local needs and the State’s requirements under Chapter 40B. [Id.].

Page 88 of the Master Plan includes limited “recommendations” for the Town vis-a-via housing and residential development. The first of those recommendations is to “plan for affordable housing.” Embedded within that recommendation of the 2015 Master Plan was for the Town to implement a Housing Production Plan (“HPP”). The following year, in late 2016, Arlington’s HPP was approved by the DHCD. Notwithstanding the existence of the HPP, on a practical level, Arlington has made extremely limited progress in advancing the creation of affordable housing in the four years since the HPP was created and the Town remains well below the state threshold of 10% affordable housing. Arlington has only 5.6% affordable housing.

**In response,** the Thorndike Place project advances the Master Plan’s recommendation that the Town plan for affordable housing, as it puts into effect the very goals of the HPP (discussed below). According to the DHCD’s SHI inventory of Arlington’s total 19,881 housing units, only 5.6% are SHI housing units. ALR’s 40B project proposal will increase the number of SHI units by 176 units, which is more than the number of affordable units added by the town during the period from 2000-2014. Likewise, with 176 new SHI units, Arlington could seek certification of its HPP and upon such certification, avail itself of a one year “safe harbor” during which Arlington can focus upon other project sites it desires for inclusion of additional affordable housing.

- **The Town Should Study and Plan for Increasing the Supply of Over-55 Active Senior Market Rate housing and Affordable/Subsidized Housing to Meet Arlington’s Population Trends.** [Master Plan, Housing Recommendation 5, p. 13].

**In response,** while Thorndike Place is not specifically targeted as an over-55 senior market rate housing and affordable housing development, the Project provides an attractive choice for the 55+ senior market, seeking either affordable housing and/or market rate housing. Thorndike Place provides a variety of unit sizes, studios, one-bedrooms, two-bedrooms and some three-bedrooms perfectly sized for empty-nesters and located within proximity to public transportation as well as an existing network of bike and walking paths (Minuteman Bike Path and Alewife Greenery Bike Path).

**II. Master Plan Goals For Land Use Include Encouraging Development That Enhances the Quality of Arlington’s Natural Resources and Build Environment. [Master Plan, p.29].**

- **“Wherever possible, Arlington should seek to direct new development to existing assets, near transit in order to reduce auto dependency and near existing services and infrastructure.”** [Master Plan, p.37].

**In response,** Thorndike Place is positioned to take advantage of existing assets, notably including the proximity to bus and subway service at nearby Alewife Station as well as the proximity to the Minuteman Bike Path. The ALR site is within .6 miles from the MBTA Alewife/Red Line Station. It is also within two-tenths of a mile from several fixed bus route stops (e.g. Bus lines #76, #62, #351, #67 and #84 and within four-tenths of a mile from bus stops

for the #77, #79 and #350 bus lines. Bus line #78 is one half mile from the Site). The site is uniquely located near the Town's existing bike path and near a number of public transportation options to reduce auto dependency. The site is likewise conveniently located less than a mile from nearby shopping, restaurants and services at Alewife as well as to outdoor recreation (Alewife Brook Reservation, Minuteman Bike Path, Thorndike Field).

In addition to the Project's ability to take advantage of the existing multimodal transportation network, the Developer has proposed a project which reduces the area of land development to a single multifamily building and would provide for permanent protection for over 11 acres of lands that have been identified as a priority for preservation. [Master Plan, p.44]. The 40B project strikes the appropriate balance of addressing the municipality's pressing need for affordable rental housing together with the desire to preserve those portions of the site it deems to be valuable from a natural resources perspective.

### **III. Arlington Master Plan Recommendations for Natural Resources and Open Space Include Pursuit of Strategies to Preserve Open Space and Manage Floodplains.**

- **The Town Should Continue Pursuit of Resolution of Mugar Land, Including Partial Development of the Land. [Master Plan, Natural Resources/Open Space Recommendation 3, p.144].**

The Master Plan details limited efforts over the past 20 years to protect, at least in part, the ALR property. The private land, while a priority for the Town in terms of protection, has also been identified as viable undeveloped land for residential housing [Master Plan, p.87]. As a pragmatic approach, the Master Plan recommends specifically for the Mugar site that the Town should continue to pursue resolution of the land, "either for partial development or open space protection." [Master Plan, p. 144, Natural Resources and Open Space Recommendation 3].

**In response,** the Thorndike Place 40B project advances both of the alternate recommendations set out in the Master Plan. Specifically, upland portions of the site would be developed for the multifamily housing and the balance of the property (more than 11 acres) would be set aside as permanently protected open space. The thoughtful balance to achieve both the property owner's rights to make use of a portion of its land and the ability to permanently protect open space for which the Town has long-sought to protect creates a win-win scenario.

The Thorndike Place 40B Project proposal directly provides a viable strategy to allow the municipality the ability to ensure that open spaces are preserved and floodplains managed. The project is ideally located to allow the residents convenient access to the nearby Minuteman Bikeway as well as to the Alewife Brook Reservation, Thorndike Field and the Alewife MTBA Station, all of which are easily accessible by foot or bike. The proposed project also limits the project size and allows for the overwhelming majority of the site to be preserved as open space. As recommended by the Master Plan, the partial development of the site allows the property owner the ability to make use of its land while also preserving the more environmentally sensitive lands in perpetuity.

- **The Master Plan’s Recommendation for Sustainable Planning and Engineering Approaches is Reflected in ALR’s 40B Proposed Affordable Housing. [Master Plan, p. 144, Natural Resources and Open Space Recommendation 5]**

**In response**, the revised project design for Thorndike Place is premised upon minimizing impact to natural resource areas, such as floodplain and wetlands buffer, and providing quality housing that relies upon a minimal development footprint. The proposed density of Thorndike Place is such that less than a third of the total land area will be developed and the remaining two-thirds can remain as protected open space. Aside from the very important goal of increasing affordable housing stock and housing diversity in Arlington, the ability for the Town to secure a permanent protection for the majority of the Mugar site is significant.

With respect to the developed portion of the site, the amount of impervious surface is largely limited to the building and the access drive and small surface parking area. Plantings to the rear of the developed portion of the site will be vegetated with native vegetation to provide an aesthetically pleasing transition to the wetland resource area and buffer thereto in the southern portion of the site. The building construction will use modular GreenStaxx units. The modular design and building system reduces and/or repurposes construction waste, uses green materials and relies upon residential sustainable design standards as the benchmark. Typical construction impacts are dramatically reduced through the use of the state-of-the art modular system. Further, the proposed building proposes the use of blue roofing, i.e., water detention on the roof which decreases impacts in storm events and flooding risks. Blue roof design can also keep the building cooler in warmer months, reducing the need for air conditioning and thereby reducing electricity consumption.

- **The Master Plan’s Recommendation 7 for Natural Resources and Open Space Suggests the Town Consider Measures to Encourage Development Projects That Respect and Enhance Adjacent Open Space and Natural Areas. [Master Plan, p.145].**

The Master Plan recognizes that recent development projects, such as the former Symmes hospital site, resulted in protection of woodlands and new public parks, demonstrating that economic development “can go hand in hand with natural resource protections.” [Master Plan, p.145.]

**In response**, ALR’s Thorndike Place similarly presents an ability for creation of affordable housing on a portion of the ALR site, with the balance of the site to be protected in perpetuity consistent with the recommendation of encouraging development that respects and enhances adjacent open spaces. Once again, the Master Plan recognizes that achievement of its multiple objectives are not exclusive of one another. The Thorndike Place proposal similarly is designed to achieve smart housing, that is transit-oriented, available to tenants of varying economic levels, ages and needs and to also provide the much-desired permanent protection on the majority of the ALR property. The Applicant’s proposal advances the Town’s recognized principle that development and natural resource protection can go hand in hand.

## **CONSISTENCY WITH ARLINGTON'S HOUSING PRODUCTION PLAN**

In late 2016, the Town of Arlington received approval on its Housing Production Plan (HPP) from the Department of Housing and Community Development (DHCD), as effective October 6, 2016<sup>2</sup>. Despite its adoption of the HPP, since 2016 the Town has not notably advanced affordable housing production in accordance with the HPP's announced objectives<sup>3</sup>.

As stated in Table 16 of the HPP, Arlington's Affordable Housing Production Goals involve an additional 100 SHI state-certified units for each year from 2016-2021. At the time of the adoption of the HPP, Arlington SHI inventory was 1,121 units (5.64%). As noted on the Town's website, the Town's affordable housing stock currently represents 5.6% of total housing units.

Within the HPP's comprehensive needs assessment, the Town found that:

- a) More than one out of every four households in Arlington (25%) have low incomes (Executive Summary, p.5<sup>4</sup>);
- b) Very few rental units on the market are available to lower income households (Executive Summary, p.6); and
- c) A need for updated housing as one out of every two homes in Arlington was constructed prior to 1939 (Executive Summary, p.6). As noted, such older homes lack heat and energy efficiency, may not be in compliance with current health, safety and building codes, and may otherwise contained lead based paint or other environmental hazards. Id.

Likewise, the need for apartment housing was also highlighted; in the period from 2000-2014, the Town of Arlington experienced approximately 1,460 rental unit conversions to condominiums, thereby depleting the supply of rental housing. Id.

Arlington's HPP sets out the very serious nature of its affordable housing need. Between the period of 1997 to 2016, the amount of affordable housing had only increased 1.21% (from 4.43% to 5.64%). The majority of the increase appears to have occurred between 1997 and 2000; according to the Town's website, in the period from 2000-2014, affordable housing only increased by .1%. Likewise, since the DHCD's approval of Arlington's HPP, there has been notably little progress in increasing the supply of affordable housing in Arlington.

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<sup>2</sup> The HPP postdates the Applicant's Comprehensive Permit Application.

<sup>3</sup> In fact, the Town may have decreased the number of affordable units since the time of ALR's 40B Application filed on September 1, 2016.

<sup>4</sup> As described within the Affordable Housing "Key Findings", at Page 31 of the HPP, the percentage of low income households is even higher, noting that one-third of Arlington households are low income, with rates especially high among elderly unrelated households. The same "Key Findings" concludes that more than one-third of all households are "cost burdened," meaning that those households pay more than 30% of annual income toward housing.

The HPP identifies the following housing “priorities” over the five years (2016-2021):

- *Expand housing supply* – the tight housing market/demand for housing results in increases in rents and sale prices, further adversely impacting low to moderate income persons. [HPP, p.56]. According to MAPC projections through 2020, several hundred additional units could be added to the housing supply to meet demand/prevent inflated sales/rental prices. *Id.*
- *Diversify the housing supply* – The senior housing population is expected to grow, requiring housing that is in proximity to services, physically accessible and convenient to needs. [HPP . 56]. According to the HPP, while the number of affordable units is slightly over 1,000 units, there are more than 5,000 potentially eligible households, many of which are elderly. *Id.* Smaller households and senior households need smaller units so they are not over-housed, which in turn creates maintenance and cost challenges. *Id.* Also, more than one-third of Arlington households are cost burdened, indicating the need for more housing at multiple price points. *Id.*
- *Update Existing Housing Stock* – one out of every two units were constructed prior to 1939. [HPP, p.56]. Of the rental housing, from 2000-2014, 1,460 rental units were converted to condominiums, resulting in a deficit of rental units and driving up of prices for rental units. *Id.*

**In response**, the Thorndike Place’s Multifamily Housing proposal affirmatively addresses Arlington’s prioritized needs as described within the HPP.

- a) Thorndike Place will expand housing supply: the total project is 176 units of which 25% (44 units) will remain in perpetuity for lease to low to moderate income households.<sup>5</sup> As part of the 40B requirements, a fair housing and marketing plan will be in place and eligible tenants are required to confirm their income eligibility on an annual basis. The monitoring of affordability likewise addresses another issue described in the Master Plan, i.e., that there is “mismatch” in existing housing whereby persons with higher incomes are living in housing that is affordable to low and moderate income persons. Here, the programmatic controls required by a 40B project, ensure that the affordable units are inhabited by persons with the qualifying income (80% AMI).
- b) Thorndike Place will diversify the housing stock. Based on the findings of the HPP, there is a very real need for i) rental housing; ii) senior housing/empty nester housing; iii) transit-oriented housing. ALR’s 40B project directly responds to each of these current shortcomings in Arlington housing supply. The proposed building is considered mid-rise (3-4 floors), and has elevator access, making it an ideal housing choice for older or mobility impaired residents. The older rental housing stock in Arlington largely prevents seniors from living in anything other than a ground floor unit. Also, while it is expected that the residents will rely on public transportation for most purposes, to the extent that residents will use cars, the majority of the parking is

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<sup>5</sup> Arlington’s HPP notes that of its affordable housing units, 254 (slightly less than 20% of current affordable housing) could expire by 2059 (and some much sooner). HPP, p.65.

- in below-ground parking, which ensures that older residents can access their vehicles in winter months without walking distances across icy surfaces and /or have cars needlessly idling for long period to melt snow on windows.
- c) Unlike the older housing stock (which is stated to represent more than ½ of the housing), Thorndike Place will be constructed with weather-tight construction, energy efficient appliances and finishes, safe interior finishes (i.e., no asbestos), and with thoughtful amenities, such as internal bike parking, outdoor community grilling and terrace space, onsite management and a community room.

The Thorndike Place 40B project will advance not only the amount of affordable and market rate rental housing options in Arlington, by 176 units, but it will also provide Arlington with recent progress toward meeting its HPP's affordable housing goals and therefore allow it to avail itself of a safe harbor under Chapter 40B in the immediate future. While the Town has adopted an HPP, the Town has not over the past four (4) years advanced its goals and objectives. Because the Thorndike Project is a rental development, the entire unit count (176 units) will be counted as SHI units. Once certified by DHCD, the Town will be able to avail itself of the safe harbor under 40B.

**HPP Goal 1 – Produce More, Diverse Housing to Address Documented Local Need.  
[HPP, p.57]**

Response: With respect to certain goals set out in the HPP, the Town's first identified goal is for Arlington to "produce more, diverse housing for extremely-low to middle income households. The Table 16 affordable housing goals propose an annual increase of 100 units for each year until 2021. Within the HAC litigation, the Town reported only 1,061 SHI units in 2018, which would mean a decrease of affordable units from 2016. Assuming the Town's representations to have been correct, Arlington is well below its annual production goals. Under the HPP, Arlington should have 1,525 SHI housing units by 2020.

Unlike a series of small, two to four-unit rental projects, the Thorndike Place proposal not only would provide 176 eligible SHI units for the Town to make progress on the statutory 10% affordable housing goal, but it also directly provides for the type of diversity in housing that is sought by the Town. Thorndike Place presents an opportunity for seniors, smaller families, single-member households and low to moderate income as well as mixed income individuals and families to reside with close proximity to public transportation, services, amenities and to remain connected to other Arlington's neighborhoods via the bike path.

**HPP Goal 3 – Integrate Affordable Units In a Broader Range of Housing Types Into the Fabric of Arlington's Existing Neighborhoods Through Redevelopment of Certain Underutilized Properties and Reuse of Existing Buildings. [HPP. p.58].**

The HPP notes that mixed income development should not be confined to commercial centers, but should also be distributed throughout town to support socioeconomic diversity of Arlington's neighborhoods.

Response: Thorndike Place presents a unique opportunity to create such desired socioeconomic diversity in East Arlington, in a traditionally residential neighborhood. While the proposal does not seek to reuse existing buildings, ALR's proposal will breathe life into land that, while possessing some natural resource value, has been misused and underused over the years. By developing a portion of the site for a dynamic multifamily development, affordable units will be integrated into this neighborhood as well as the Thorndike Place community. As the number of affordable units (44) within the project will remain a constant, all units will be developed to the same standards and there is no artificial distinction between housing quality for the various socioeconomic residents. Similarly, the proposal to incorporate open space restrictions on the undeveloped areas of the property will cement the status of that portion of the property as protected open space.

**HPP Goal 4 – Foster an Aging Supporting Community Via Housing Choices That Enable Older Adults to Thrive in Arlington as They Age.**

Response: Thorndike Place provides Arlington's senior population a choice of living accommodations to be responsive to smaller household size. Given the proximity of public transport (subway and bus), services and amenities are easily accessible without reliance on driving. Long-term Arlington residents can remain members of the community, without staying in a home that has outgrown the seniors' living needs and/or income.

**In summary**, Arlington's HPP was intended to address the outstanding needs of the community concerning housing supply and demand, the lack of housing options for persons, especially those who are income burdened and the need to prevent a decline in Arlington's historic tradition of being a diverse community and open to all socioeconomic parts of society. Thorndike Place addresses those very needs and provides rental housing options that, to date, have been largely lacking in Arlington.

**CONSISTENCY WITH ARLINGTON'S OPEN SPACE AND RECREATION PLAN (2015-2022)**

Arlington's open spaces and recreational facilities are set out in the Open Space and Recreation Plan ("OSRP").[ OSRP, p.72]. The OSRP recognizes that since 2007, the "most significant changes" in open space acreage since 2007 have arisen in relation to the protections on privately held lands: the former Symmes Hospital site and Elizabeth Island. *Id.* At Symmes, 8.5 acres of the 18-acre site are protected as park and/or woodland under conservation restrictions; the land is owned by the development company<sup>6</sup>.

While the Mugar Site is identified within the OSRP as an "Open Space and Recreational Facility," the property is not currently owned by the Town, nor does the Town hold any conservation restriction on the property. [See OSRP, p.72]. The OSRP also notes that the Town

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<sup>6</sup> Within that proposal, the developer obtained approval for 164 rental units and 12 condominiums (Arlington 360). Despite the number of allowable units, the Town only obtained 26 affordable units and less than half of the site was protected. The 2-acre Elizabeth Island is protected and owned by the Arlington Land Trust.

has not been able to identify a viable path to preserve any portion of the Mugar site, including a prior town vote to acquire the land. OSRP, p. 89].

**THE THORNDIKE PLACE PROPOSAL ADVANCES OSRP GOALS. [OSRP, pp.122-123]**

As stated within the OSRP's Goals and Objectives [OSRP, pp122-123], the first stated goal is to acquire ecologically valuable land or ensure protection through conservation restrictions or other means. ALR's 40B proposal includes protecting a portion of its lands via a conservation restriction or similar mechanism. The Town could achieve desired protection over the designated area without otherwise outright purchasing the land and instead, use municipal staff and funding resources to otherwise achieve OSRP goals and objectives.

The OSRP's third goal is to coordinate and strengthen local and regional planning and management of open spaces with various Town Departments. [OSRP, p.123]. Here too, the ZBA in working with ALR can forge a path to address Arlington's outstanding housing needs (affordable housing/diversity of housing choices/transit-oriented housing/low impact housing) while simultaneously advancing the Town's Open Space priorities. As noted, Arlington has sought a path for the protection of the floodplain and natural resources at the Mugar site for well over twenty years; the ALR 40B project responsibly identifies upland development and protection for the more sensitive areas of the site.

**Response:** ALR's Thorndike Place proposal provides a path to advance Arlington's desire to formalize protection on the majority of the site to ensure that the vast majority of wetland resource areas and floodplain on the site remain protected open space. Not only would such protections ensure that no future development on the protected lands occur, but it would also allow the Town to serve as a steward of such restricted area.

**THE THORNDIKE PLACE PROPOSAL IS CONSISTENT WITH THE OSRP ACTION PLAN/OPEN SPACE AND RECREATIONAL PRIORITIES. [OSRP, pp.124-225].**

The OSRP prioritizes protection of ecologically valuable land "such as the Mugar property... that could be lost as open space." [OSRP, p.124].

**Response:** While the Mugar property is casually referenced as ecologically valuable land, the real context is that the floodplain and wetland resource areas are desired for protection. The upland portions of the site, to the north and northwest of the site are not floodplain and instead are currently overgrown areas tucked adjacent to a densely developed residential area. That portion of the Mugar site to the north and northwest can be developed, as proposed by Applicant, to blend into the residential neighborhood. The majority of the site, to the east and southeast, abutting Route 2, can properly be protected. The Applicant, the Town and its community can work together toward a path to steward the undeveloped lands, as such stewardship models may exist with other protected areas, such as the private lands at the former Symmes Hospital.

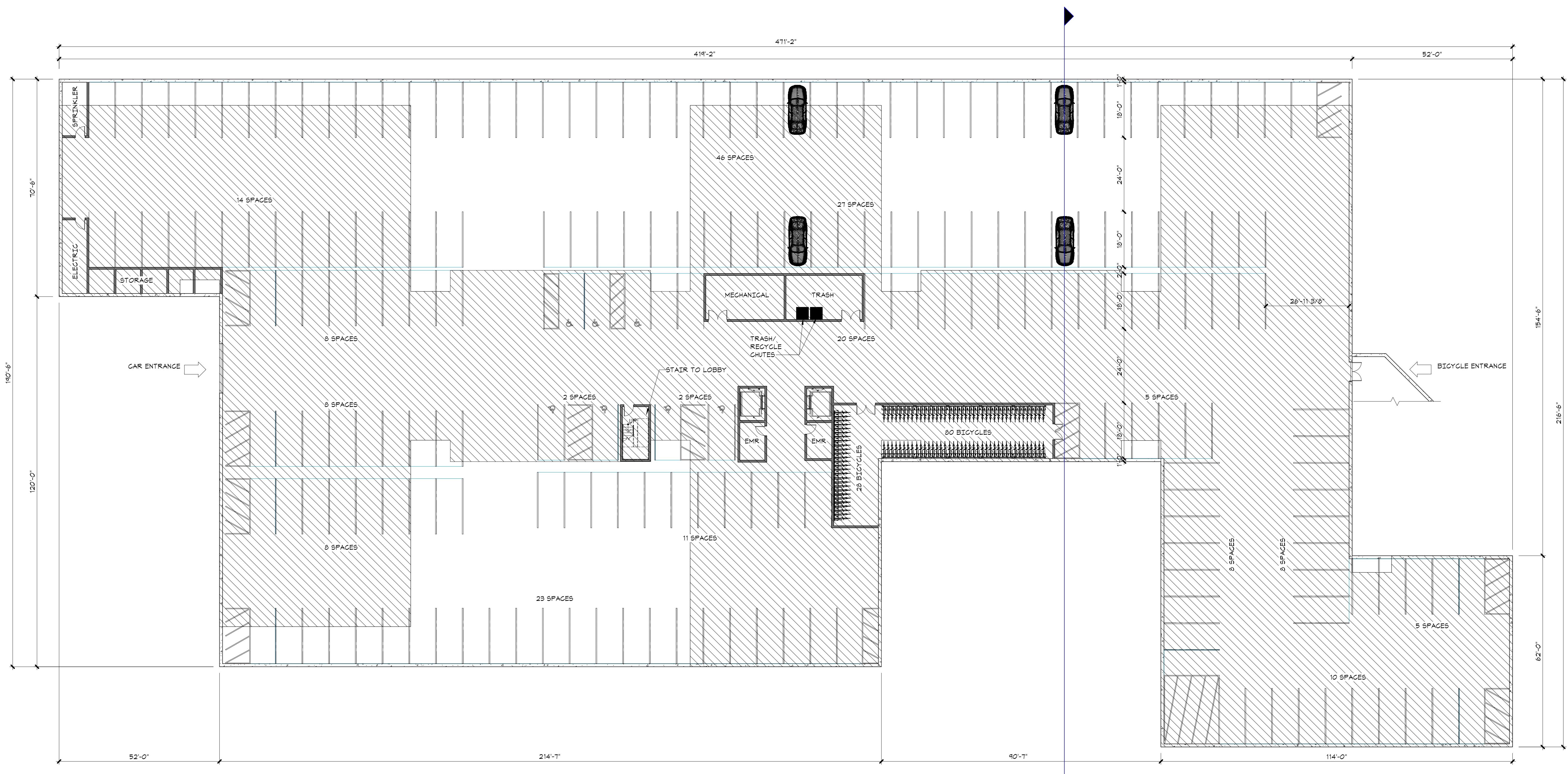
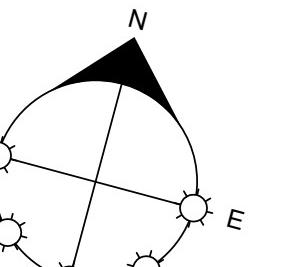


THORNDIKE APARTMENTS  
3D VISUALIZATION  
DOROTHY ROAD LOCKING WEST  
NOVEMBER 3, 2020

green  
**STAXX**



BRUCE  
RONAYNE  
HAMILTON  
ARCHITECTS



**TOTAL: 205 SPACES  
GARAGE: 12,428 SF**

### GARAGE PLAN

0' 4' 8' 16'

**THORNDIKE  
APARTMENTS**

ARLINGTON, MA.

11/3/20

ARCHITECTURE  
LAND PLANNING  
INTERIOR DESIGN  
3D VISUALIZATION



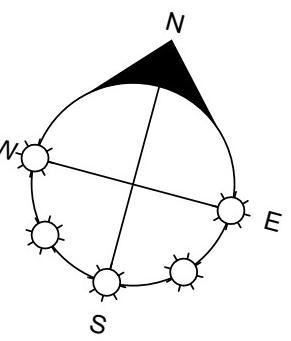
green  
**STAXX**  
BRUCE  
RONAYNE  
HAMILTON  
ARCHITECTS

833 TURNPIKE ROAD P.O. BOX 104  
NEW IPSWICH NEW HAMPSHIRE 03071



**GROUND FLOOR PLAN**

0' 4' 8' 16'

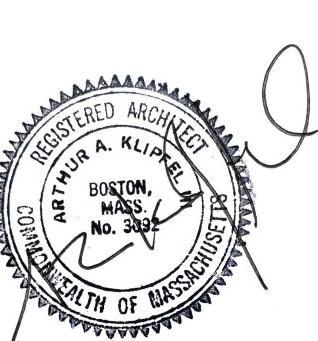


**THORNDIKE  
APARTMENTS**

ARLINGTON, MA.

11/3/20

ARCHITECTURE  
LAND PLANNING  
INTERIOR DESIGN  
3D VISUALIZATION



green  
**STAXX**

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HAMILTON  
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TYPICAL FLOOR PLAN

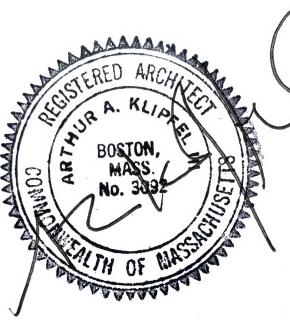


**THORNDIKE  
APARTMENTS**

ARLINGTON, MA.

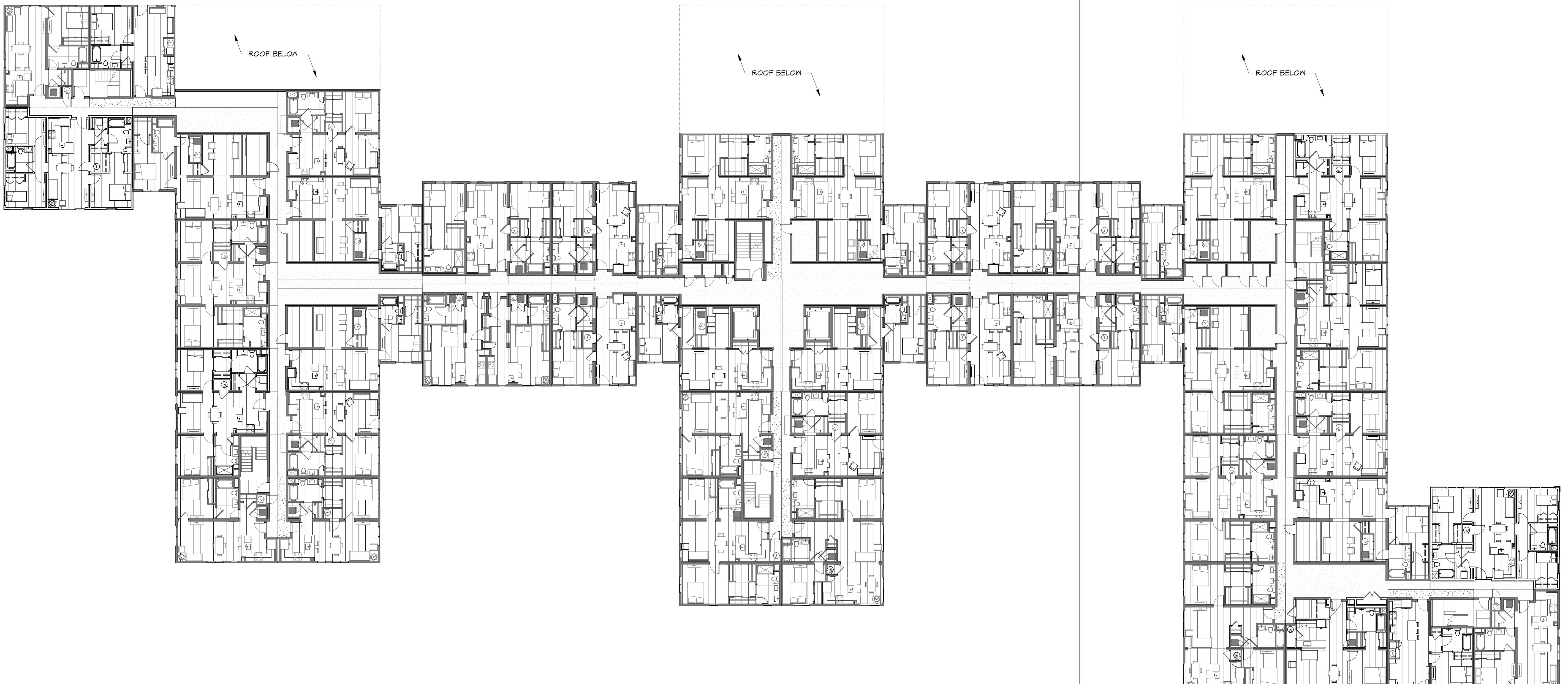
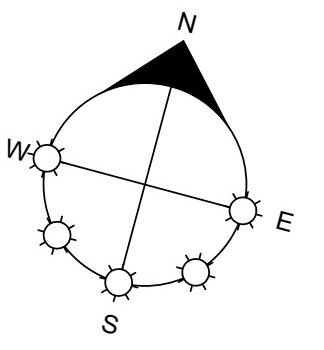
11/3/20

ARCHITECTURE  
LAND PLANNING  
INTERIOR DESIGN  
3D VISUALIZATION



green  
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HAMILTON  
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833 TURNPIKE ROAD P.O. BOX 104  
NEW IPSWICH NEW HAMPSHIRE 03071



**176 TOTAL UNITS  
FOURTH FLOOR: 45,076 SF**

#### FOURTH FLOOR PLAN

0 4' 8' 16'

#### THORNDIKE APARTMENTS

ARLINGTON, MA.

11/3/20

ARCHITECTURE  
LAND PLANNING  
INTERIOR DESIGN  
3D VISUALIZATION



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HAMILTON  
ARCHITECTS

833 TURNPIKE ROAD P.O. BOX 104  
NEW IPSWICH NEW HAMPSHIRE 03071



WEST ELEVATION

1/8" = 1'-0"



EAST ELEVATION

1/8" = 1'-0"

#### MATERIAL LEGEND

- [A] CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT
- [B1] CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT
- [B2] CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT
- [B3] HORIZONTAL ACCENT SIDING, COLOR BY ARCH
- [B4] PANEL JOINT
- [C] COMPOSITE TRIMS, COLOR BY ARCHITECT
- [D] INSULATED WINDOW & DOOR UNIT, WITH OPERABLE PANELS AS INDICATED
- [E] JULIET BALCONY
- [F] CONCRETE FOUNDATION WALL W/ PARGE COATING STUCCO FINISH, COLOR BY ARCHITECT
- [G] VERTICAL BATTEN SIDING
- [H] AWNING WITH CABLE ROD SUPPORTS
- [J] ENTRANCE DOORS
- [K] OVERHEAD DOOR

EAST / WEST ELEVATION



#### NOTE: BUILDING CONSTRUCTION TYPE

##### 1-STORY UNDERGROUND PARKING

PER IBC 2015, SECTION 510.2 "HORIZONTAL BUILDING SEPARATION ALLOWABLE", A BUILDING OF USE TYPE S-1(PARKING GARAGE PER.) AND TYPE 1A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM AND SEPARATED FROM CONSTRUCTION ABOVE BY A HORIZONTAL ASSEMBLY WITH A 3 HOUR FIRE RESISTANCE RATING IS ALLOWED TO BE CONSIDERED A SEPARATE BUILDING.

##### 4-STORY RESIDENTIAL APARTMENTS

PER IBC 2015, TABLE 504.4 "ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE", A BUILDING OF USE TYPE R-2 AND TYPE 5A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM IS ALLOWED TO BE 4 STORIES.  
PER TABLE 504.4 "ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE", A BUILDING OF USE TYPE R-2 AND TYPE 5A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM IS ALLOWED TO BE 4 STORIES.

**THORNDIKE  
APARTMENTS**

ARLINGTON, MA.

11/3/20

ARCHITECTURE  
LAND PLANNING  
INTERIOR DESIGN  
3D VISUALIZATION



green  
**STAXX**  
BRUCE  
RONAYNE  
HAMILTON  
ARCHITECTS



**NORTH ELEVATION - WEST  
END**

1/8" = 1'-0"



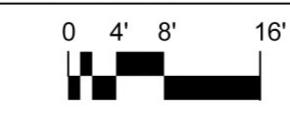
**NORTH ELEVATION - EAST  
END**

1/8" = 1'-0"

### MATERIAL LEGEND

- |                                                         |                                                                               |
|---------------------------------------------------------|-------------------------------------------------------------------------------|
| A CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT    | D INSULATED WINDOW & DOOR UNIT, WITH OPERABLE PANELS AS INDICATED             |
| B1 CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT | E JULIET BALCONY                                                              |
| B2 CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT | F CONCRETE FOUNDATION WALL W/ PARGE COATING STUCCO FINISH, COLOR BY ARCHITECT |
| B3 HORIZONTAL ACCENT SIDING, COLOR BY ARCH              | G VERTICAL BATTEN SIDING                                                      |
| B4 PANEL JOINT                                          | H AWNING WITH CABLE ROD SUPPORTS                                              |
| C COMPOSITE TRIMS, COLOR BY ARCHITECT                   | I ENTRANCE DOORS                                                              |
|                                                         | J OVERHEAD DOOR                                                               |

### NORTH ELEVATION



#### NOTE: BUILDING CONSTRUCTION TYPE

##### 1-STORY UNDERGROUND PARKING

PER IBC 2015, SECTION 510.2 "HORIZONTAL BUILDING SEPARATION ALLOWABLE": A BUILDING OF USE TYPE S-1(PARKING GARAGE PER ) AND TYPE 1A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM AND SEPARATED FROM CONSTRUCTION ABOVE BY A HORIZONTAL ASSEMBLY WITH A 3 HOUR FIRE RESISTANCE RATING IS ALLOWED TO BE CONSIDERED A SEPARATE BUILDING.

##### 4-STORY RESIDENTIAL APARTMENTS

PER IBC 2015, TABLE 504.4 "ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE", A BUILDING OF USE TYPE R-2 AND TYPE 5A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM IS ALLOWED TO BE 4 STORIES.

PER TABLE 504.4 "ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE", A BUILDING OF USE TYPE R-2 AND TYPE 5A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM IS ALLOWED TO BE 4 STORIES.

### THORNDIKE APARTMENTS

ARLINGTON, MA.

11/3/20

ARCHITECTURE  
LAND PLANNING  
INTERIOR DESIGN  
3D VISUALIZATION



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HAMILTON  
ARCHITECTS



**SOUTH ELEVATION - EAST  
END**

1/8" = 1'-0"



**SOUTH ELEVATION - WEST  
END**

1/8" = 1'-0"

<b>MATERIAL LEGEND</b>	
A	CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT
B1	CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT
B2	CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT
B3	HORIZONTAL ACCENT SIDING, COLOR BY ARCH
B4	PANEL JOINT
C	COMPOSITE TRIMS, COLOR BY ARCHITECT
D	INSULATED WINDOW & DOOR UNIT, WITH OPERABLE PANELS AS INDICATED
E	JULIET BALCONY
F	CONCRETE FOUNDATION WALL W/ PARGE COATING STUCCO FINISH, COLOR BY ARCHITECT
G	VERTICAL BATTEN SIDING
H	AWNING WITH CABLE ROD SUPPORTS
I	ENTRANCE DOORS
K	OVERHEAD DOOR

**SOUTH ELEVATION**

0' 2' 4' 8'

**NOTE: BUILDING CONSTRUCTION TYPE**

**1-STORY UNDERGROUND PARKING**

PER IBC 2015, SECTION 510.2 "HORIZONTAL BUILDING SEPARATION ALLOWABLE", A BUILDING OF USE TYPE S-1(PARKING GARAGE PER ) AND TYPE 1A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM AND SEPARATED FROM CONSTRUCTION ABOVE BY A HORIZONTAL ASSEMBLY WITH A 3 HOUR FIRE RESISTANCE RATING IS ALLOWED TO BE CONSIDERED A SEPARATE BUILDING.

**4-STORY RESIDENTIAL APARTMENTS**

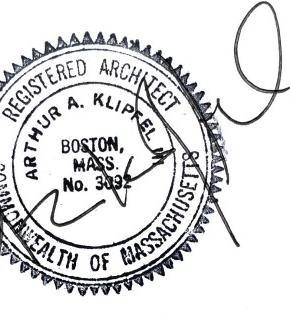
PER IBC 2015, TABLE 504.4 "ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE", A BUILDING OF USE TYPE R-2 AND TYPE 5A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM IS ALLOWED TO BE 4 STORIES. PER TABLE 504.4 "ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE", A BUILDING OF USE TYPE R-2 AND TYPE 5A CONSTRUCTION AND PROTECTED THROUGHOUT BY AN AUTOMATIC SPRINKLER SYSTEM IS ALLOWED TO BE 4 STORIES.

**THORNDIKE  
APARTMENTS**

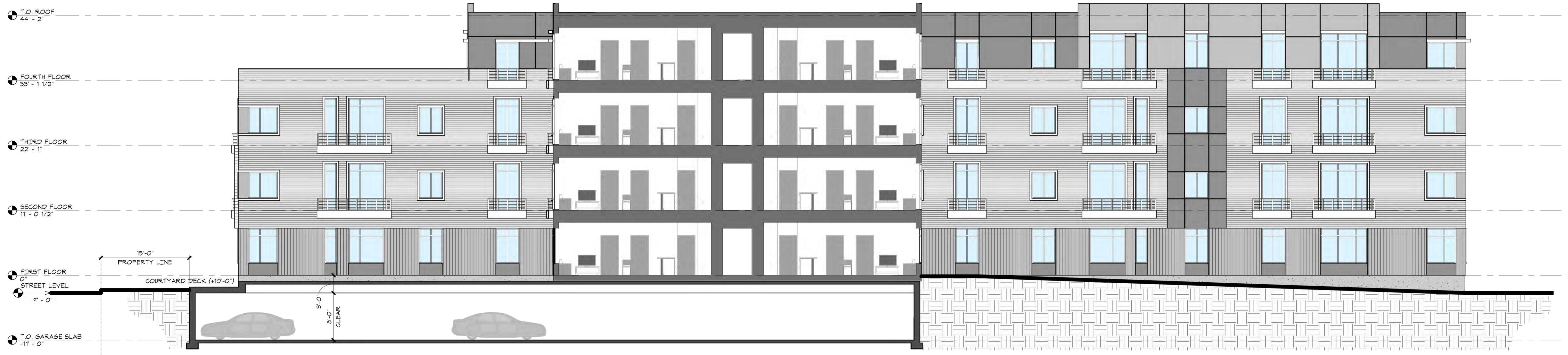
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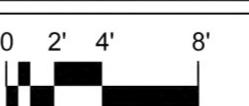
ARCHITECTURE  
LAND PLANNING  
INTERIOR DESIGN  
3D VISUALIZATION



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SCHEMATIC BUILDING SECTION



**THORNDIKE  
APARTMENTS**

ARLINGTON, MA.

11/3/20

ARCHITECTURE  
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INTERIOR DESIGN  
3D VISUALIZATION



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833 TURNPIKE ROAD P.O. BOX 104  
NEW IPSWICH NEW HAMPSHIRE 03071



## Town of Arlington, Massachusetts

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### Review draft 2021 meeting schedule

#### **Summary:**

Review draft 2021 meeting schedule

#### **ATTACHMENTS:**

Type	File Name	Description
<input type="checkbox"/> Reference Material	ConComm_Schedule_2021.pdf	Draft 2021 Meeting Schedule



TOWN OF ARLINGTON

MASSACHUSETTS

CONSERVATION COMMISSION

Schedule for 2021

The Commission usually meets the 1<sup>st</sup> and 3<sup>rd</sup> Thursdays of the month (except where noted below) at 7:30pm in the second floor conference room of the Town Hall Annex (southwest entrance).

January 7<sup>th</sup>  
January 21<sup>st</sup>

July 1<sup>st</sup>  
July 15<sup>th</sup>

February 4<sup>th</sup>  
February 25<sup>th</sup>

August 5<sup>th</sup>  
August 19<sup>th</sup>

March 4<sup>th</sup>  
March 18<sup>th</sup>

September 2<sup>nd</sup>  
\*September 16<sup>th</sup>

April 1<sup>st</sup>  
April 15<sup>th</sup>

October 7<sup>th</sup>  
October 21<sup>st</sup>

May 6<sup>th</sup>  
May 20<sup>th</sup>

November 4<sup>th</sup>  
November 18<sup>th</sup>

June 3<sup>rd</sup>  
June 17<sup>th</sup>

December 2<sup>nd</sup>  
December 16<sup>th</sup>

Respectfully submitted,

Approved

Emily Sullivan  
Environmental Planner & Conservation Agent



## Town of Arlington, Massachusetts

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### Regulation Update

#### **Summary:**

Regulations Update:

Section 31: Climate Change Resilience

Section 23: Floodplain

Section 24: Vegetation Removal and Replacement

#### **ATTACHMENTS:**

Type	File Name	Description
❑ Reference Material	Section_31_Climate_Change_Resilience.pdf	Section 31: Climate Change Resilience
❑ Reference Material	Section_23_Floodplain.pdf	Section 23: Floodplain
❑ Reference Material	Vegetation_Section_24.pdf	Section 24: Vegetation Removal and Replacement

## **Section 31 – Climate Change Resilience**

A. The impacts of climate change can adversely affect each Resource Area's ability to provide and promote the resource area values protected by the Bylaw. (See definitions of "adaptation" and "alter" and "impacts of climate change" in Section 4 above). Resource Areas are critical to building a community's resilience/adaptation to the impacts of climate change due to their ability to provide for flood control, storm damage prevention, and other Resource Area Values.

B. The Applicant shall, to the extent practicable and applicable as determined solely by the Commission, integrate considerations of adaptation planning into their project to promote climate change resilience so as to protect and promote resource area values into the future. These considerations are especially important in Land Subject to Flooding (floodplain) and Riverfront Area and other Resource Areas which protect the interest of Flood Control and Storm Damage Prevention, including Adjacent Upland Resource Areas. These Resource Areas may be directly impacted by extreme weather events expected to be more prevalent or more intense due to climate change, in surface runoff of pollutants, and in wildlife habitat due to changes in temperature.

The Applicant shall consider the project's adaptation to potential climate change impacts by addressing the following:

- (1) Describe project design considerations to limit storm and flood damage during extended periods of disruption and flooding as might be expected in extreme weather events. See Vegetative Wetlands Section 21, Land Subject to Flooding Section 23, and Adjacent Upland Resource Area Section 25, of these Regulations.
- (2) Describe project stormwater surface runoff, which may increase due to storm surges and extreme weather events, and how this will be managed / mitigated to prevent pollution (including nutrients from fertilizers, roadway runoff, etc.) from entering the resource area with consideration of eliminating impervious surfaces as feasible. See Stormwater Management Section 33 of these Regulations.
- (3) Describe project vegetation / planting plans and other measures to improve the resiliency of the wildlife habitat of the resource area to withstand potential temperature and rainfall changes (drought and excess) due to climate change. See Vegetation Removal and Replacement Section 24 of these Regulations.
- (4) Describe measures to protect proposed structures and minimize damage to structures due to the impacts of climate change.

## **Section 23 - Land Subject to Flooding (Bordering and Isolated)**

### A. Findings.

- (1) Bordering land subject to flooding.
  - (a) Bordering land subject to flooding is an area which floods from a rise in a bordering waterway or water body. Such areas are presumed to be significant to flood control and storm damage prevention and protection of surrounding land and other homes or buildings. In these ways, bordering land subject to flooding is important in mitigating the negative impacts of climate change.
  - (b) Bordering land subject to flooding provides a temporary storage area for floodwater which has overtapped the bank of the main channel of a creek, brook, river or stream or the basin of a pond or lake. During periods of peak runoff, floodwaters are both retained (i.e., slowly released through evaporation and percolation) and detained (slowly released through surface discharge) by bordering land subject to flooding. Over time, incremental filling of these areas causes increases in the extent and level of flooding by eliminating flood storage volume or by restricting flows, thereby causing increases in damage to public and private properties and downstream resource areas.
  - (c) The hydrologic regime, plant community and structure, topography, soil, and proximity to water bodies or vegetated wetlands provide important food, shelter, migratory, and overwintering areas, and breeding for wildlife.
  - (d) The hydrologic regime, surrounding plant community, topography, soil, and proximity to water bodies or vegetated wetlands make bordering land subject to flooding allow vegetation to successfully grow in these areas.
- (2) Isolated land subject to flooding.
  - (a) Isolated land subject to flooding is an isolated depression or a closed basin which serves as a ponding area for runoff or high groundwater which has risen above the ground surface. Such areas are likely to be locally significant to flood control and storm damage prevention. In this way, isolated land subject to flooding is important in mitigating the impacts of climate change. In addition, where such areas are underlain by pervious material they are likely to be significant to public or private water supply and to groundwater supply. Where such areas are underlain by pervious material covered by a mat or organic peat and muck, they are also likely to be significant to the prevention of pollution. Isolated land subject to flooding provides important breeding habitat for amphibians and some rare plants. Isolated land subject to flooding provides a temporary storage area where runoff and high groundwater pond and slowly evaporate or percolate into the substrate. Filling causes lateral displacement of the ponded water onto contiguous properties, which may result in damage to said properties.
  - (b) Isolated land subject to flooding, where it is underlain by pervious material, provides a point of exchange between groundwater and surface waters. Contaminants introduced into said area, such as road salts, find easy access into the groundwater. Where these conditions occur and a mat of organic peat or muck covers the substrate of the area, said mat serves to detain and remove contaminants which might otherwise enter the groundwater.

B. Definitions, critical characteristics and boundaries.

(1) Bordering land subject to flooding.

- (a) Bordering land subject to flooding is an area with low, flat topography adjacent to and inundated by floodwaters rising from brooks, creeks, rivers, streams, pond or lakes. It extends from the banks of these waterways and water bodies; where a bordering vegetated wetland occurs, it extends from said wetland.
- (b) The topography and location of bordering land subject to flooding specified in the foregoing Subsection B(1)(a) are critical to the protection of the interests specified in subsection A(1) above.
- (c) The boundary of bordering land subject to flooding is the estimated or observed maximum lateral extent of floodwater which will theoretically result or has resulted from the statistical 1%-annual-chance flood (also known as the one-hundred-year-frequency storm).
1. Said boundary shall be that determined by reference to the most recently available flood profile data prepared for the Town of Arlington within which the work is proposed under the National Flood Insurance Program (NFIP, currently administered by the Federal Emergency Management agency, successor to the U.S. Department of Housing and Urban Development). Said boundary, so determined, shall be presumed accurate. This presumption may be overcome only by credible evidence from a registered professional engineer or other professional competent in such matters.
  2. Notwithstanding the foregoing, where NFIP profile data is unavailable or is determined by the Commission to be outdated, inaccurate or not reflecting current conditions, the boundary of bordering land subject to flooding shall be the maximum lateral extent of floodwater which has been observed or recorded or the Commission may require the applicant to determine the boundary of Bordering Land Subject to Flooding by engineering calculations which shall be:
    - i. based upon a design storm of 8.48 inches of precipitation in 24 hours (from "Cornell" atlas);
    - ii. based upon the standard methodologies set forth in U.S. Soil Conservation Service Technical Release No. 55, Urban Hydrology for Small Watersheds and Section 4 of the U.S. Soil Conservation Service, National Engineering Hydrology Handbook; and
    - iii. prepared by a registered professional engineer or other professional competent in such matters.

(2) Isolated land subject to flooding.

- (a) Isolated land subject to flooding is an isolated depression or closed basin without an inlet or an outlet. It is an area which at least once a year confines standing water. Isolated land subject to flooding may be underlain by pervious material, which in turn may be covered by a mat of peat or muck.
- (b) The characteristics specified in the foregoing Subsection B(2)(a) are critical to the protection of the interests specified in Subsection A(2) above.
- (c) The boundary of isolated land subject to flooding is the perimeter of the largest observed or recorded volume of water confined in said area.

C. No activity, other than the maintenance of an already existing structure, which will result in the building within or upon, or removing, filling, dredging or altering of, land subject to flooding shall be conducted without written permission of the Conservation Commission.

D. The Commission may permit activity on land subject to flooding provided it shall not result in the following:

- (1) Flood damage due to filling which causes lateral displacement of water that would otherwise be confined within said area;
- (2) Adverse effect on public and private water supply or groundwater supply, where said area is underlain by pervious material;
- (3) An adverse effect on the capacity of said area to prevent pollution of the groundwater, where the area is underlain by pervious material which in turn is covered by a mat of organic peat and muck.

The applicant shall take into consideration the impacts of climate change on the activities proposed on land subject to flooding, especially in terms of the compensatory flood storage as a climate change resilience strategy. Any such activity shall provide compensatory flood storage for all flood storage volume that will be lost at each elevation. Compensatory flood storage shall be at a 2:1 ratio, minimum, for each unit volume of flood storage lost at each elevation.

Compensatory flood storage shall mean a volume not previously used for flood storage, shall have an unrestricted hydraulic connection to the same waterway or water body, and, with respect to waterways, shall be provided within the same reach of the river, stream, or creek. No new parking areas or garages shall be used as compensatory flood storage. The Commission has found that use of such areas or garages results in a significant or cumulative effect upon the resource area values protected by the Bylaw, and has found that these facilities can result in the uncontrolled acute or chronic release of these harmful materials into the resource areas protected by the Bylaw. The Commission has also found that using these structures for flood storage can result in the damage of vehicles and property under flooding conditions.

E. No work shall be performed within 50 feet of land subject to flooding that abuts an estimated habitat area as designated on the most current map prepared by the Massachusetts Natural Heritage and Endangered Species Program unless the Applicant can demonstrate by a preponderance of credible evidence that the work will not have any short term or long term adverse effect on the resource area values protected by the Bylaw.

## **Section 24 - Vegetation Removal and Replacement**

A. Findings: Vegetation in a resource area protected by the Bylaw is significant for wildlife, wildlife habitat and water quality. In addition, vegetation controls flood and storm damage, thereby mitigating potential impacts of climate change. Vegetation provides food, shelter, socialization, shade, water detention, sediment control, bank stabilization, biodiversity, pollutant uptake, evapotranspiration of water, aesthetics, and atmospheric purification. In addition, plant size ordinarily is proportional to habitat value; i.e., large wooded trees are of greatest habitat value, followed by bushes, and then ground cover. Thus, an adequate quantity of vegetation must be maintained so that resource areas protected by the Bylaw can provide the resource area values protected by the Bylaw, including, but not limited to: flood control, storm damage prevention, pollution abatement, wildlife protection, aesthetic value, and recreation.

B. No vegetation in a resource area protected by the Bylaw shall be damaged, extensively pruned, or removed without written approval by the Commission and in-kind replacement. Extensive pruning is defined as removal of 20% or more of limbs or growth. For extensive pruning or removal of vegetation because of an Imminent Risk to Public Health and Safety, in-kind replacement shall be to the extent practicable as determined by the Commission (See Section 9 of these Regulations for Emergency Certification).

C. "In-kind replacement" shall refer to a combination of species type and surface area as defined by the area delineated by the drip line of the affected plant(s). "In-kind" means the same type and quantity of plant species that was removed, extensively pruned, or damaged, unless compelling evidence is presented in writing that explains why the resource area values under the Bylaw are promoted through an alternative proposal, and planted within the same resource area or another resource area located in close proximity on the project site. Notwithstanding the foregoing, only non-invasive plant species shall be planted as replacements.

D. The criteria for removal of vegetation follow. In all instances, the reasons for removal must be expressed in writing before the removal. In administering this standard, the Commission shall consider species selection, location, and timing of the plantings.

(1) Health of Vegetation

Vegetation in a state of irreversible decay, or undesirable vegetation present as a result of unintentional lack of maintenance may be offered as a reason(s) for removal.

(2) Bank or Slope Stabilization

A bank or slope stabilization plan requires the restructuring of soils occupied by vegetation.

(3) Invasive Species

The vegetation being removed is an aggressive, invasive, or non-native species as confirmed by wetlands scientist or as listed on a wetlands plant list acceptable to the Commission, such as, but not limited to that published by the United States Fish and Wildlife Service.

(4) Ecological Restoration

The vegetation is being removed as part of a project whose primary purpose is to restore or otherwise improve the natural capacity of a resource area to protect and sustain the interests of the Bylaw; also called Resource Area Enhancement.

(5) Vegetation Replacement

The vegetation is being removed and replaced elsewhere on the project site or within the same resource area, only if the Commission determines that such removal and replacement does not decrease the resource area's contribution to the resource area values protected by the Bylaw.

(6) Imminent Risk to Public Health and Safety

The vegetation is an imminent risk to public health or safety or property as confirmed in writing and submitted to the Commission by the Arlington Tree Warden, Fire Department Representative, Public Safety Officer, or a certified arborist.

E. Application for Removal. For all projects, the application for vegetation removal shall be submitted as part of the application for permit or Notice of Intent as described by the Bylaw and these regulations. At a minimum, the application will include:

(1) Narrative

The narrative shall describe the existing conditions, the proposed planting plan, the list of existing and proposed species, the size of existing and proposed species, and number of plants before and after the revegetation event. The narrative shall also provide the rationale for the removal, by addressing the criteria D1 through D6 above, and discuss the proposed maintenance plan (see (7) below).

(2) Affirmation of the Revegetation Activities

All plans for revegetation must be accompanied by written testimony and scaled diagram from a certified arborist or wetland scientist or landscape architect. At a minimum, this document must include the following information:

- (a) Is the vegetation removal necessary? (See D. above)
- (b) How much surface area of the vegetation will be removed ( $\text{ft}^2$ -based on drip line)?
- (c) How many individual plants will be removed by species; *i.e.*, is the species list submitted with the NOI correct?

(3) Planting Plan

The proposed planting plan must be drawn to scale and identify properly the resource area and buffer zone and the project site. It must include the locations of each replacement species and the number of each species proposed for planting (in table form).

The planting plan and procedures shall comply with the American Standards for Nurserymen, Inc. or equivalent. It must also include the location of the erosion control devices used during the restoration event. A brief narrative must accompany this planting plan describing the storage location of all motorized equipment.

The planting plan shall show the estimated tree canopies after 15 years of growth, the specific names, sizes and locations of trees to be planted, and the total area of square feet of the area shaded by tree canopies. In determining the shaded area, measure the shaded area assuming that the shaded area is only that area directly under the drip line.

(4) Existing Species List

Each species existing before the restoration shall be listed in terms of area of coverage (ft<sup>2</sup>) and number of individual plants and either height or dbh as specified in the tables below.

(5) Replacement Species List

The replacement of vegetation shall be according to the following table (derived from the American Standards for Nurserymen, Inc.), unless the Applicant proves that the amount of replacement vegetation will not survive or contribute in the long-term to resource area values. A rationale for the species and size choice must be provided if the replacement is not "in-kind".

Native species are the preferred; invasive species are not allowed.

Replacement plant materials shall conform to the requirements described in the latest edition of American Standard for Nursery Stock, which is published by the American Association of Nurseryman ("AAN").

Replacement size shall be most common available substantial size, as approved by the Commission.

Vegetation replacement is not considered successful until the replacement plants have survived three full growing seasons.

For extensive pruning or removal of vegetation because of an Imminent Risk to Public Health and Safety, in-kind replacement shall be to the extent practicable as determined by the Commission (See Section 9 of these Regulations for Emergency Certification).

(a) Tree:

Existing	Replacement
Trunk (dbh)	Quantity
3 to 8 inches	1
8 to 20 inches	2
> 20 inches	3

## (b) For all trees:

1. If a plant is well grown with a single stem, well-shaped and bushy, and has sufficient well-spaced side branches to give it weight and good bud qualities, it is an acceptable plant.
2. On multi-stem trees, height shall be defined as the measurement taken from the ground level to the average uppermost point of growth of the plant.
3. All replacement plants shall have ball sizes which are of a diameter and depth to encompass enough of the fibrous and feeding root system as necessary for the fully recovery of the plant once planted.
4. Sapling trees shall include deciduous trees with a dbh of 1 inch and less; evergreens of 2 feet or less and shall be replaced at the discretion of the Commission so as to reach an equivalent area of coverage and soil retention.

## (c) For Shrubs:

The replacement of shrubs (bushes) shall be with bushes and shrubs of equivalent size. For bushes, the replacement must be well grown with a single stem, well-shaped and bushy, and have sufficient well-spaced side branches to give it weight and good bud quality as per the American Association of Nurserymen standards.

- (6) Rationale for Removal - Describe why the interests of wetlands protection are advanced by the revegetation plan.
- (7) Maintenance Plan - Vegetation replacement is not considered successful until the replacement plants have survived three full growing seasons. The maintenance plan shall describe how the restoration will be evaluated annually for three years and reported to the Commission. The Commission reserves the right to require a revised replanting plan, or additional plantings on an annual basis in the event that the revegetation plants decay or die.

F. The Commission may require one or more of the following measures to protect vegetation during work:

- (1) Tree protection fencing – Prior to commencing work, four (4) foot-high snow fencing shall be installed and secured with wooden stakes (2" x 4" or 2" x 3") or 6-foot steel channel posts so as to create an enclosure at the dripline of tree(s) or other distance as the site conditions allow to be protected. Such fencing shall be securely erected, be vertically plumb and be maintained for the duration of the project and shall protect individual trees or groups of trees.
- (2) Tree protection blanket – “BarkSavers” or similar armored blankets shall be installed and maintained according to product specifications.
- (3) No existing trees shall be used for crane stay, guys or other fastening.
- (4) Vehicles shall not be parked below the canopy of any existing tree or where damage may result to existing trees or tree roots.
- (5) Construction materials shall not be stored beneath existing trees.
- (6) Following completion of work, have a certified arborist monitor the health of trees on site for possible damage and take measures to repair damage.

(7) Prior to work, preparation of a tree protection plan showing summary of all trees on site (including dbh, species, extent of canopy, roots and health) and specifying whether each tree shall be saved or lost.

G. The Commission may require the placement of permanent bounds (e.g., granite or metal) to demarcate all or part of a resource area or vegetation mitigation area.

H. The requirements of this section shall be met commensurate with the nature, scope, type, and cost of the proposed project or activity.